13 June 1988

MEMORANDUM FOR: C/OTS/OEG

FROM: [redacted] 25X1
OTS/OEG/ESD/EB

SUBJECT: Commercial Profile Evaluation of the Christie CASP 1 Battery Conditioner [redacted] 25X1

REFERENCE: ESD Project 87SUR004 [redacted] 25X1

1. PROJECT NO. 88SUR005 [redacted] 25X1

2. RECOMMENDATION:

a. Approve the Christie CASP 1 battery conditioner for procurement and field use. The CASP does an excellent job of charging, discharging, and conditioning batteries commonly used in field operations.

b. Run the unit off a regulated power supply in areas where the local AC voltages vary below 90 or above 130 volts (below 180 or above 265 for 220 volt setting). Operation is unreliable for voltages outside the 90 to 130 (180 to 265 volt) range. See subparagraph 5c. [redacted] 25X1

3. BACKGROUND:

One Christie CASP 1 (S/N 01F6009GF) was submitted for evaluation under 87SUR004. During baseline testing the unit suffered a catastrophic failure when a power transistor inside the unit exploded during routine operation. A second unit (S/N 01F6010GF) was made available for testing, but it never functioned properly. Both units were repaired by the manufacturer and returned to OTS for this evaluation. [redacted] 25X1

4. DESCRIPTION:

a. The Christie CASP 1 is a microprocessor controlled battery processing device. CASP is an acronym for Charger-Analyzer-Sequencer-Power Supply. The CASP 1 has the ability to charge, discharge, or cycle a variety of batteries including; Nickel Cadmium, Lead Acid and Silver Zinc. CASP's programming flexibility also makes it possible to charge any type of rechargeable battery if the battery parameters are known. Three charging methods are available to the user: constant potential, constant current, and reflex. In reflex charging, a high charge pulse is followed by a lower energy

[redacted] 25X1

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discharge pulse. The negative pulse allows the battery to release excess gases. This raises the charging efficiency as more of the charging energy goes into the battery instead of into heat.

b. The CASP 1 is capable of processing up to six batteries at once; either sequentially or "simultaneously". As a sequencer, the unit charges each battery fully before charging the next battery. The "simultaneous" method also charges sequentially, but it charges each battery in 10 second intervals until all are fully charged. In the discharge mode, the discharge current is constant until the battery voltage decreases to a specified cutoff point. The ANALYZE/RECOND key analyzes or reconditions a battery by a charging, discharging, and recharging.

c. Each 4-pin Christie Battery Cable is identified by a number (100-131) which corresponds to a specific 1% resistor connected between pins 3 and 4 (ground). For the 32 cable ID's, these resistance values ranged between 3K and 30K during testing. The CASP 1 recognizes this resistance and converts it to the cable number which corresponds to a user programmable battery parameter file. Therefore, the user should only charge a battery in conjunction with its corresponding cable. The CASP 1 memory contains 20 storage files for battery parameters. Battery parameters are: charge current, discharge current, ampere-hours, number of cells, charge time, discharge cutoff voltage per cell, and charge cutoff voltage per cell. Before CASP 1 can be used for processing, the operator must obtain the parameters from a battery data book and program the parameters into any one of the 20 storage files. CASP 1 memory also contains a storage space for each of the 32 available battery cables. Each cable contains a blue wire (Pin 2) which is connected to the temperature terminal of a battery. Pushing the yellow "TYPE" key displays information on the LCD screen which should correspond to the battery type. The "HISTORY" key gives the time taken to charge or discharge the battery during the previous cycle as well as the cause of the battery cutoff. Once the battery is connected to its specified cable, any realtime information can be displayed using the "VOLTS" or "AMPS" keys. The yellow arrows allow the user to read any of the yellow key parameters on each of the six channels anytime during processing. Battery charging occurs between pin 1 (+) and pin 4 (-).

d. The Alpha-Numeric green keys are used in conjunction with the green shift key for programming and file inspection. The red "STOP" key terminates a charge or discharge operation.

e. Pushing the "SHIFT" "V" causes the CASP 1 to become a power supply provided a 2.80 K ohm resistor is connected between pins 3 and 4 of the battery connectors. All six channels are paralleled in this mode and therefore, supply the same voltage at each output. The output voltage and amperage (with maximum limits in parenthesis) are displayed on the screen. The unit can be programmed for both current or voltage regulation. Programming can be changed by accessing storage file 099.

f. The Christie CASP 1 Battery Charger is designed to accept line voltage from 90 to 130 and 180 to 265 Vac, 47 to 440 Hz with no switching or reconnection necessary to accommodate these ranges. The unit automatically senses the input voltage and sets itself correctly. It has a maximum output of 42 Vdc and can supply up to 14 amperes of charging current. Its maximum output power is 350 watts.

g. The CASP 1 is shown in Figure 1. The unit has the following physical dimensions:

Height	:	3.50 in.
Width	:	8.75 in.
Depth	:	12.75 in.
Weight	:	12.40 lbs (U)

5. PERFORMANCE:

a. Environmental: The CASP 1 Battery Charger (S/N 01F6009GF) suffered negligible degradation in electrical performance over the environmental sequence. It was subjected to environmental tests in accordance with the procedures specified by PBS-1005 (August 1985) for Indoor Controlled Temperature equipment. Operating temperatures were modified to 0°C and +50°C. Storage temperatures were modified to -5°C and +60°C. During humidity, a small amount of corrosion formed on the screws that hold the top and bottom covers in place. Some corrosion was also apparent on the latches that secure the computer module to the power supply module. After one day at +50°C, a corner of the membrane keyboard came loose from the front panel.

b. Measured Data: The CASP 1's electrical performance was satisfactory. Table 1 illustrates the measured performance of the CASP 1 (S/N 01F6009GF) at 120 Vac (60 Hz). Baseline tests were also performed on S/N 01F6010GF. Differences between the two units were negligible.

c. Power Requirements: The CASP 1 was operated successfully over AC line voltages from 90 to 130 and 180 to 265 Vac and frequencies from 45 to 65 Hz. Operation outside the 90 to 130 and 180 to 265 Vac ranges is unreliable. The front panel keyboard locks up and, although the LCD does not go out, the unit stops charging. If power is interrupted during charging, the charger remembers its place and resumes charging where it left off when power is reapplied. Memory is backed up by a lithium battery.

d. Workmanship: The Christie CASP 1 conforms to good commercial workmanship practices. Excess flux is present on a few solder joints; however, in general the soldering is satisfactory. The integrated circuits in the unit are mounted in sockets and all components are identified. Each of the six front panel connectors is internally fused with a small 20A fuse that is soldered into the printed circuit board located directly behind the front panel. The position of two rack mount handles on the front panel interferes slightly with the connection and removal of battery connector cables. (U)

6. DOCUMENTATION:

A 129-page manual was supplied with the CASP 1. The manual contains a description of the front panel and an explanation of the different kinds of battery processing available. Instructions for programming the unit, step-by-step operating instructions, and a calibration procedure are also included. In the rear pocket of the manual is a computer print-out of the values which have been pre-programmed into the CASP's internal computer tables. The programmer password located on this print-out is USMART. The password must be entered to change any of the pre-programmed values in the computer tables. The documentation adequately explains operation of the unit; however, no schematics, component placement diagrams or repair procedures are included. [redacted] 25X1

7. SOURCE:

OTS/OG/TSD/TRB
Manufactured by: Christie Electric Corp.
Torrance, CA 90501 [redacted] 25X1

8. EQUIPMENT DISPOSITION:

One unit (S/N 01F6009GF) was returned to TSD/TRB, and the other unit (S/N 01F610GF) will be retained by ESD for future compatibility testing. [redacted] 25X1

9. COORDINATION:

The results of this evaluation have been discussed with Joe Schmank of OTS/OG/TSD/TRB. [redacted] 25X1

[redacted] 25X1

Distribution: [redacted] 25X1
Orig - ESD Project File 88SUR005
1 - C/OTS/OEG
1 - DC/OTS/OG/E&P
1 - OTS/OEG/ESD/EB
1 - C/OTS/OG/TSD/TRB
1 - C/OTS/OG/CCD/TRB
1 - C/OTS/ATG/PD
1 - OTS/OEG/ESD/COB (Attn: J. Perdeus)

Full Field Distribution [redacted] 25X1

TABLE 1
PERFORMANCE DATA FOR THE
CHRISTIE CASP 1 BATTERY CHARGER

PARAMETER	MANUFACTURER'S SPECIFICATIONS	MEASURED DATA S/N 01F6009GF	UNITS
REFLEX DISCHARGE PULSE FREQUENCY	Not Specified	1	Hz
POWER SUPPLY OUTPUT CURRENT	14.00 Max. Not to Exceed 350W	14.00	A
POWER SUPPLY OUTPUT VOLTAGE	42.00 Max. Not to Exceed 350W	42.00	Vdc
CHARGE CURRENT	Programmable to a Maximum of 14.00 (in .01 increments)		A
4.00		4.20	
3.00		3.20	
2.00		2.15	
1.00		0.99	
0.50		0.49	
0.10		0.08	
DISCHARGE CURRENT	Programmable to a Maximum of 4.00 Not to Exceed 60W		A
4.00		4.10	
3.00		3.05	
2.00		2.05	
1.00		1.05	
0.50		0.50	
0.10		0.09	
END OF CHARGE VOLTAGE	Programmable		Vdc
16.00		15.80	
15.00		14.83	
14.00		13.81	
13.00		12.83	
12.00		11.81	
11.00		10.82	
10.00		9.82	
END OF DISCHARGE VOLTAGE	Programmable		Vdc
12.00		12.27	
11.00		11.30	
10.00		10.28	
9.00		9.28	
8.00		8.28	
AMPERE-HOUR ACCURACY	Not Specified		A-H
	Calculated Ampere-Hrs.		
	.50	.50	
	7.63	7.54	
	12.00	12.00	
	15.97	15.86	

TABLE 1 (Continued)
PERFORMANCE DATA FOR THE
CHRISTIE CASP 1 BATTERY CHARGER

PARAMETER	MANUFACTURER'S SPECIFICATIONS		MEASURED DATA S/N 01F6009GF		UNITS
AC CURRENT DRAIN	6 Max. Fused		STDBY	1A CHARGE INTO 12 V SIMULATED BATTERY	A rms
	Vac	Hz			
	90	45	.21	.40	
		65	.19	.36	
	130	45	.17	.33	
		65	.16	.29	
	180	45	.12	.25	
		65	.12	.23	
	265	45	.12	.21	
		65	.15	.21	
	Power Supply Mode			14A Load	
	90	45	.21	3.9	

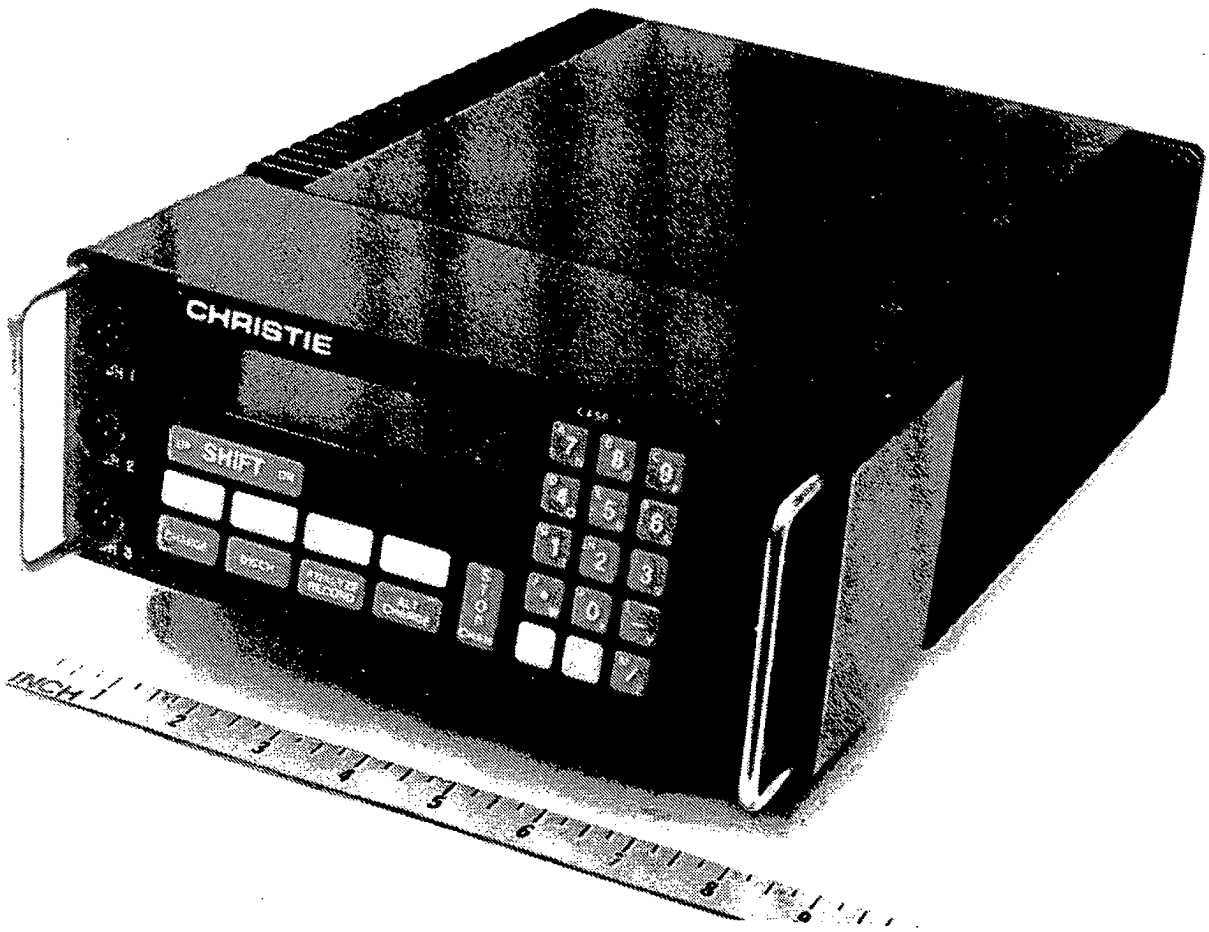


Figure 1. The CHRISTIE CASP 1 Battery Processor.

C A S P 1

BATTERY CARE INSTRUMENT

STAT

CHARGER - ANALYZER - SEQUENCER - POWER SUPPLY

OPERATOR'S MANUAL

CHRISTIE ELECTRIC CORP.

20665 Manhattan Place

Torrance, California 90501, U.S.A.

PHONE: (213) 320-0808

TLX/TWX 910-349-6260

Manual No. TD543-4V40

Software Version: 4.4

WARNING

1. BEFORE INITIATING BATTERY PROCESSING:

THREE THINGS THE CASP OPERATOR MUST VERIFY BEFORE USING THE INSTRUMENT TO PROCESS BATTERIES:

- -- THAT THE PROPER CABLE IS BEING USED FOR EACH BATTERY BEING PROCESSED.[1]
- -- THAT EACH CABLE NUMBER IS CALLING THE CORRECT BATTERY PARAMETER NUMBERS FROM THE COMPUTER (these set values such as the charge and discharge current).[2]
- -- THAT THE VALUES ENTERED IN THE PARAMETER TABLES ARE APPROPRIATE FOR THE BATTERIES BEING CHARGED.[2 & 3]

FAILURE TO VERIFY THESE ITEMS CAN RESULT IN EXCEEDING THE LIMITS OF THE BATTERY BEING PROCESSED, CAUSING DAMAGE TO THE BATTERY OR EVEN ITS VIOLENT FAILURE.

2. PRIOR TO ANY USE:

The operator must verify that the programmed battery processing and power supply parameters do not exceed the ratings in Appendix III. Failure to verify these items can result in damage to CASP, even though CASP has extensive self-protecting features.

3. DURING INITIAL PROCESSING:

At least when FIRST using CASP to process a type of battery not previously processed at your facility, or when using a previously untried process on a particular battery, the programmed parameters must be verified by observation: THE BATTERY MUST BE MONITORED CLOSELY THROUGHOUT PROCESSING FOR EXCESSIVE HEATING OR VENTING, ABNORMAL LOSS OF ELECTROLYTE, BULGING, OR OTHER FAULTY SIGNS.

If any faulty signs are observed, PRESS THE GREEN "UP" SHIFT KEY, AND THEN THE RED "STOP" KEY. MOVE PERSONNEL A SAFE DISTANCE AWAY.

NOTES:

1. Cable identification instructions are located in para. G-4.3.1
2. Instructions for inspecting all the Parameter Tables are in para. H-3, of the CASP Operators Manual and further described in the CASP Programmer's Manual, para. BB-3.
3. Instructions for programming all the parameter tables for a particular battery are in the CASP Programmer's Manual, sections CC, DD, and EE.

4. BEFORE USING CASP IN THE POWER SUPPLY MODE:

THE OPERATOR MUST BE SURE THE EQUIPMENT TO BE OPERATED IS CONNECTED TO CASP WITH CABLES MARKED "P/S" OR "098" FOR POWER SUPPLY CABLE.

WARNING: NEVER CONNECT BATTERIES TO CASP USING POWER SUPPLY CABLES.

5. FURTHER WARNINGS:

TO PREVENT ELECTRIC SHOCK, MISCALIBRATION OR DAMAGE TO YOUR CASP, NEVER REMOVE ANY COVER. THERE ARE NO USER-SERVICEABLE PARTS INSIDE. REFER ANY SERVICING NEEDS TO CHRISTIE'S QUALIFIED SERVICE PERSONNEL.

NOTICE

The specifications contained in both the CASP Operator's Manual and CASP Programmer's Manual are subject to change without notice. The contents of both these documents are believed to be accurate. If errors are found, please notify Christie Electric Corp. at the address shown on the title page.

The following is a list of trademarks used within these documents:

reFLEX is a trademark of Christie Electric Corp.

EQUIPMENT LIST

Your CASP and its external equipment consist of:

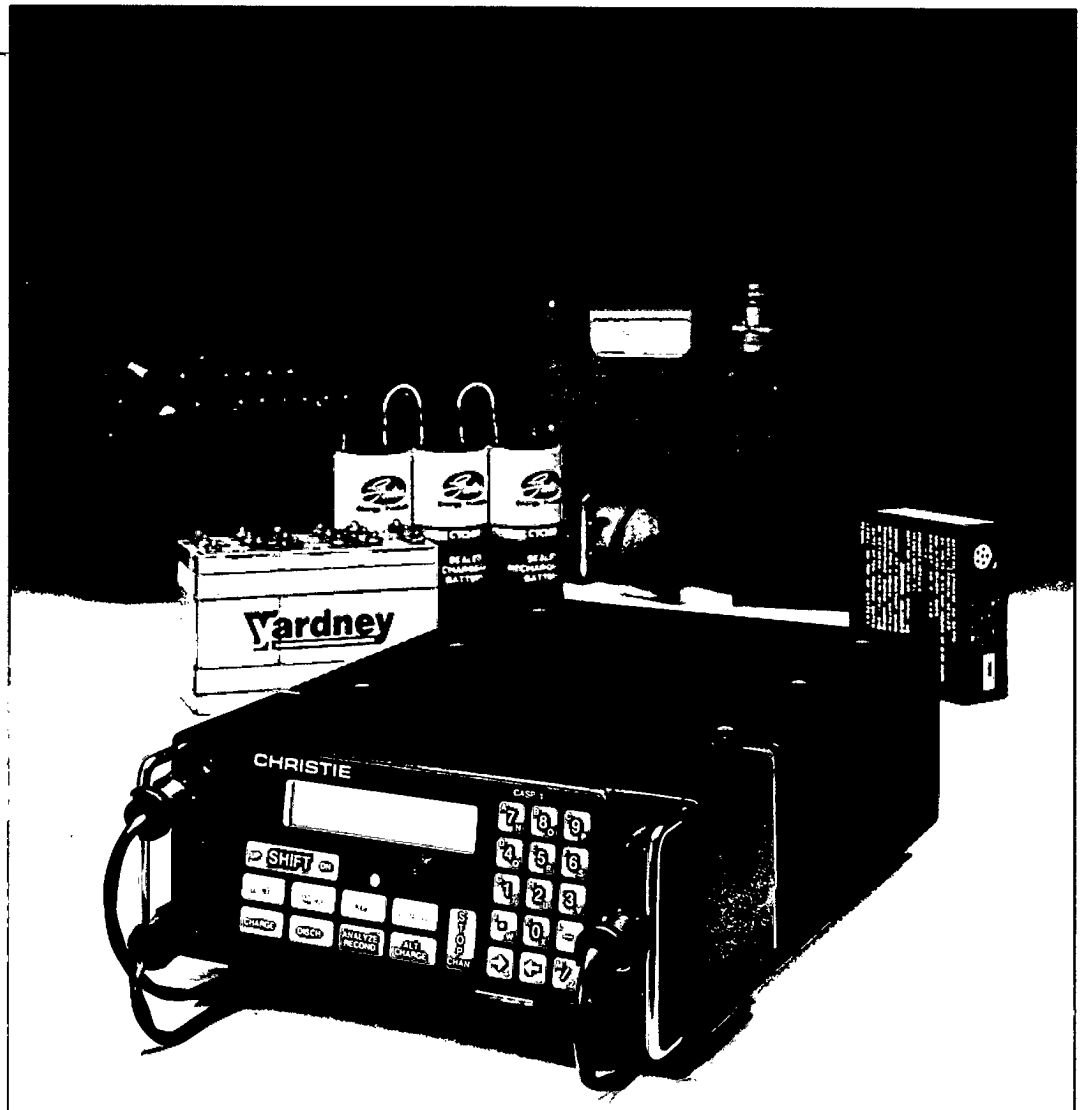
A front microcomputer module with keyboard
A rear switcher type power module for AC input
A power cord for 120VAC
Six programmable output cables of your choice
(May include one or more power supply cables)

Optional equipment available:

Additional programmable battery or power supply cables
External discharge boosters
Snap-in printer module which fits between the front and rear modules
A DC input power module in lieu of the AC module.
A high voltage version of the power module.

CASP™

CHARGER • ANALYZER • SEQUENCER • POWER SUPPLY



CHRISTIE
ELECTRIC CORP.

CASP™

CHARGER • ANALYZER • SEQUENCER • POWER SUPPLY

ELIMINATE BATTERY PROBLEMS

CASP, with its unique reFLEX charging as well as computer diagnostics and treatment, ensures that batteries are quickly charged, fully reliable, have increased capacity and an extended life.

VERSATILITY

CASP automatically charges or analyzes any type of battery—sealed nickel-cadmium, vented aircraft nickel-cadmium, sealed and vented lead-acid, silver-zinc or any other type such as rechargeable lithium. That means that CASP can never become obsolete.

CASP also shows digital voltage, current, time, ampere-hour and other information on its LCD. It can store it, recall it, print it and even graph it. It can also turn into a 350-watt programmable dc power supply (battery eliminator) upon command.

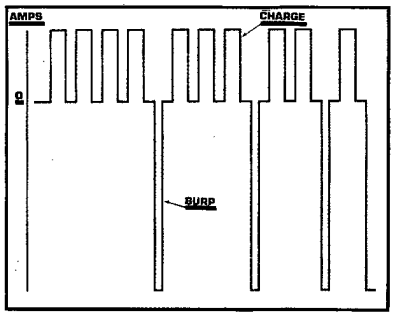
CONVENIENCE

CASP automatically handles up to 6 assorted batteries or 6 power supply outputs; it operates on any mains power anywhere in the world (90 to 265 volts, 47 to 440 Hz); and it can even work on an input of 12 or 28 volts dc with an optional plug-in module. Its color-coded keyboard with its single function as well as alpha-numeric keys make it simple to operate, and its relatively small size and light weight make it easily portable. In addition, it has an I/O port which may be used for connection of a bar code reader or a computer printer.

ULTRA-FAST, HIGHER CAPACITY, LONGER LIFE

Christie batteries can be recharged in 20 minutes or less; other ni-cads may take somewhat longer. Batteries are more fully charged, stay cooler, have less cell imbalance, mostly overcome battery memory or capacity fading, and outlive other batteries—all due to Christie's reFLEX charging process.

In the case of ni-cads, the secret to all these benefits is the repeated interjection of reFLEX negative/discharge pulses during charging. Just like burping a baby that is being bottle-fed, so reFLEX burps the battery during charging to get rid of its gases. This, together with large positive pulses, raises the charging efficiency so significantly that more charging energy goes into the battery rather than into heat. In fact, the time saved is just the by-product.



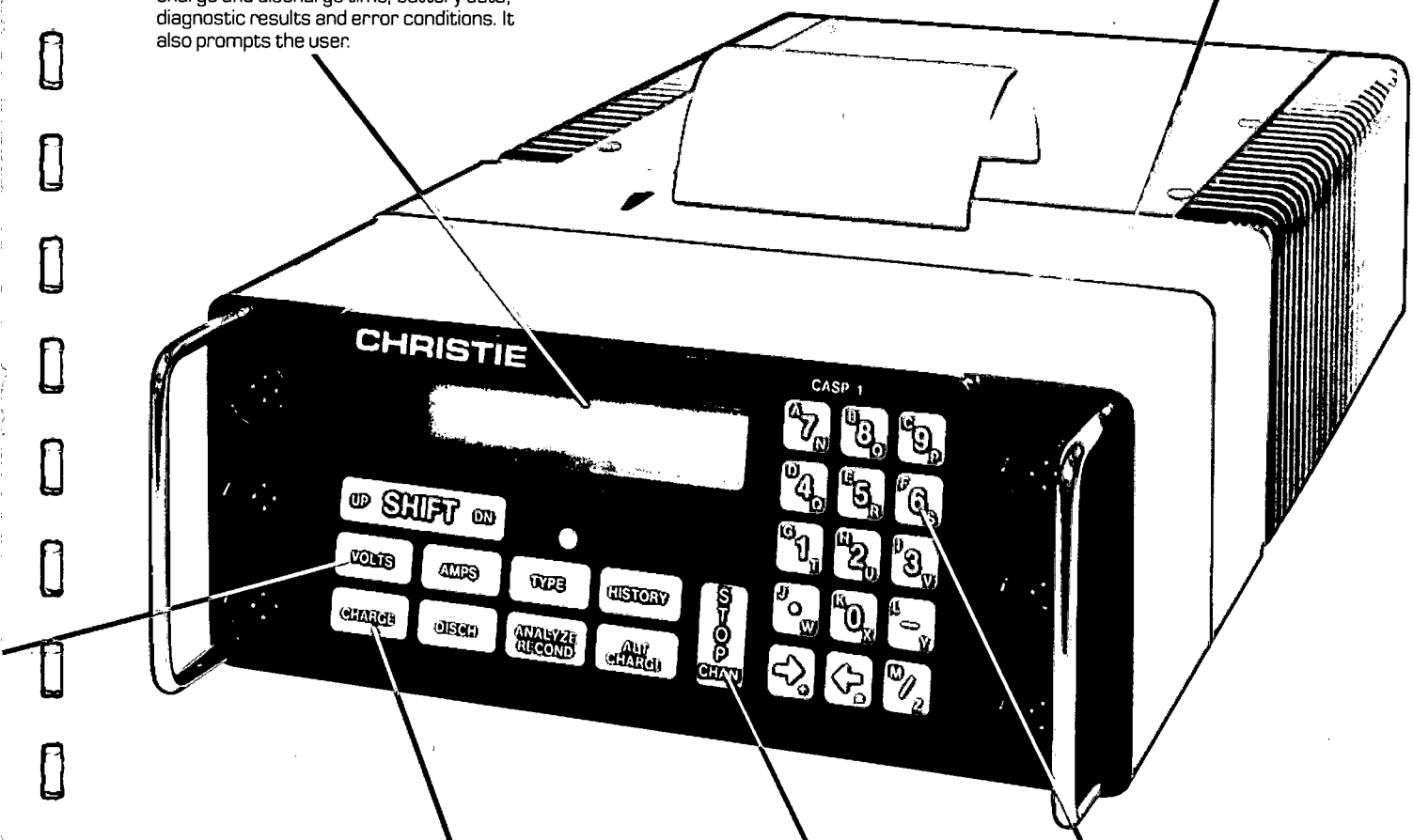
YELLOW KEYS DISPLAY DIGITAL DATA & RECALL BATTERY DESCRIPTION OR CHARGE & ANALYZE RESULTS

- AMPS Key—turns the LCD into a digital ammeter to indicate charge and discharge current values.
- VOLTS Key—turns the LCD into a digital voltmeter. Under reFLEX charge, it automatically displays the voltage at the completion of the negative pulse (trough voltage).
- TYPE Key—displays the battery name plate data.
- HISTORY Key—displays charge & analyze results of any connected battery.
- → and ← Keys—permit the reading of amps, volts, type, or history on the next higher or lower channel.

LCD DISPLAY

Displays volts, amps, ampere-hour, elapsed charge and discharge time, battery data, diagnostic results and error conditions. It also prompts the user.

PRINTER



RED KEY

Stops current activity.

BLUE KEYS INITIATE THE SAME ACTIVITY ON EACH OF THE 6 CHANNELS

- CHARGE Key—initiates the best type of charge procedure—rapid or ultra-rapid when appropriate—for any type of rechargeable battery: sealed cylindrical nickel-cadmium packs, aircraft sintered vented ni-cads, sealed or vented lead-acid, silver-zinc, or any other. (See also ANALYZE/RECOND Key and ALT CHARGE Key for other charge procedures.)
- DISCHARGE Key—discharges each ni-cad battery to an average of one volt per cell to ready it for shipment.
- ANALYZE/RECOND Key—discharges each ni-cad battery to an average of typically one volt per cell and then automatically recharges it. Displays charge ampere-hours on the LCD. (NOTE: THIS KEY CAN ALSO BE USED ROUTINELY TO RECHARGE NI-CADS THAT GET LITTLE DISCHARGE.)
- "UP" SHIFT plus ANALYZE/RECOND Key—charges, discharges, and then recharges each battery. Tests battery discharge capacity and displays discharge ampere-hours on the LCD.
- "DN" SHIFT plus ANALYZE/RECOND Key—automatically discharges and then recharges each battery three times in succession. This procedure is recommended for reconditioning ni-cad batteries with faded capacity (memory).
- ALT CHARGE Key—starts slow charge (typically 14 hours each at a constant current equivalent to one-tenth of each battery ampere-hour rating).
- "UP" SHIFT plus ALT CHARGE Key—starts slow charge, but the total time for up to six batteries will be the same as for just one battery.

GREEN ALPHA-NUMERIC KEYBOARD ENTERS INFORMATION, GIVES COMMANDS & REPROGRAMS

This keyboard enters battery serial number or other information. It also gives commands for printing, for activating an external discharge booster, for turning CASP into a power supply and by authorized personnel with an access code—for reprogramming charge, discharge & analyze values or modes.

GENERAL DESCRIPTION

CHARGER - ANALYZER - SEQUENCER - POWER SUPPLY
all-in-one

IT CONSISTS OF:
- a front microcomputer module
- a rear switcher type power module
- an optional printer module which fits in between the front & rear modules

IT IS:
- universal—will charge & analyze any type of rechargeable battery
- ageless—can never become obsolete
- ultra-fast—full charge in 15 to 20 minutes with Christie reFLEX batteries
- very easy to use
- small & light

IT HAS:
- 6 channels for processing 6 different batteries, or powering 6 pieces of dc equipment.
- automatic battery recognition
- a unique 4-way sensing system
- wide input voltage & frequency capability, with optional dc input

ENGINEERING DATA

AC INPUT—90 to 265 volts, 47 to 440 Hz; no switching or reconnection required

OPTIONAL ALTERNATE DC INPUT—9 to 36 volts dc; no switching or reconnection required

MAXIMUM CHARGER OUTPUT—42 volts and 14 amps, but not to exceed 350 watts

TIME FOR FULL CHARGE—15 to 20 minutes for Christie reFLEX ni-cad packs up to 30 volts and 60 watt-hours (e.g., 12-D, 24-C cells); proportionally longer for larger ni-cads. Other types and makes of ni-cads, including aircraft sintered vented types, will be fully charged in 40 minutes or more. Lead-acid (sealed and vented), silver-zinc and other batteries will be charged in the shortest time appropriate for those batteries, commensurate with CASP's maximum rated output.

DC POWER SUPPLY OUTPUT—voltage and current programmable; maximum voltage is 42 volts, maximum total current for the six parallel outputs is 14 amps, with total not to exceed 350 watts. Maximum output ripple/noise above 6 volts is 0.3% rms/1% peak-to-peak; maximum voltage or current regulation above 6 volts or amps is 2.5%.

DISCHARGER RATING—0 to 4 amps, not to exceed 60 watts. This can be increased by means of an optional external regulated discharge booster.

AMBIENT TEMPERATURE RANGE—0 to 50°C (32 to 122°F)

EMI/RFI—per MIL-STD-461, FCC Part 15J, VDE 0871

SIZE—inches: 8¾ wide x 14½ deep x 3½ high
cm: 22.2 wide x 36.8 deep x 8.9 high
Fits standard half-rack

WEIGHT—12 lbs/5.5 kg.

OPERATIONAL FEATURES

SINGLE FUNCTION KEYS—most functions can be performed by simply pressing a single key with the corresponding marking; blue keys initiate activities, yellow keys call up information on the screen.

ALPHA-NUMERIC KEYBOARD—CASP also includes an alpha-numeric keyboard besides its various single function keys. This green colored keyboard allows manual entry of battery serial numbers or other information. It is also used in commands for printing, activating an optional external discharger and in turning CASP into a dc power supply. By means of an access code, this keyboard can also be used by authorized personnel to reprogram charge, discharge and analyze values or modes.

LCD SCREEN—provides a readout for the digital voltmeter, ammeter, ampere-hour and elapsed charge and discharge time meter, as well as for various battery data and diagnostic results, prompting and indication of error conditions.

POWER INTERRUPTIONS—CASP is designed for virtually unlimited power interruptions; resumes operation from point of interruption and data is cumulative.

SPEAKER—sounds different tones for input verification, errors and function termination.

FUNCTIONS

COMPATIBLE BATTERIES—any of CASP's battery processing functions below can be performed with sealed cylindrical cell ni-cad packs, aircraft sintered vented ni-cads, sealed and vented lead-acid, silver-zinc, or with any other rechargeable battery.

REGULAR CHARGE—will fully charge batteries in optimum manner—ultra-fast (15 to 20 minutes), fast (40 minutes to 2 hours), or slower—as appropriate for the battery or limited by CASP's maximum rated output.

ALTERNATE CHARGE—typically 14 hours constant current in sequence or simultaneously.

DISCHARGER—discharges ni-cads to an average of one volt per cell.

ANALYZER A—automatically performs the function of the discharger followed by the regular charge; tests and displays charge ampere-hours. This shorter test is normally only meaningful with reFLEX charging.

ANALYZER B—automatically performs the regular charge, followed by the above discharge, followed by a second regular charge. Tests and displays discharge ampere-hours.

RECONDITIONER—automatically performs three discharge-regular charge cycles for battery forming, conditioning or reconditioning.

SEQUENCER—automatically processes (charge, discharge, analyze or recondition) up to six intermixed batteries in sequence.

POWER SUPPLY—pressing a letter on the keyboard turns CASP into a voltage and current programmable dc power supply with six parallel outputs.

ORDERING INFORMATION

CASP WITH AC INPUT ONLY—Model CASP 1*
CASP WITH DC INPUT ONLY—Model CASP DC1*
CASP WITH AC & DC INPUT—Model CASP 1 plus Module P/N 120619-001
OPTIONAL SNAP-IN PRINTER—thermal, 40-column: Model CP-40
OPTIONAL EXTERNAL DISCHARGE BOOSTER—Model CDC-60

*Other CASP models also available

20665 Manhattan Place • Torrance, California 90501 U.S.A. • 213-320-0808 • 800-421-2955 • TWX 910-349-6260

CHRISTIE
ELECTRIC CORP.

CASP 2/85 PRINTED IN U.S.A.

Declassified in Part - Sanitized Copy Approved for Release 2012/10/16 : CIA-RDP09-02457R000100850001-2

CASP OPERATOR'S MANUAL

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SECTION A
ABOUT CASP MANUALS

A-1 THE OPERATOR'S MANUAL

Before attempting to use your CASP, you should read this CASP Operator's Manual--particularly these portions:

WARNINGS: page 1
Section B: How Your Facility Can Use CASP
Section C: Getting Acquainted with CASP
Section D: Understanding Processing Batteries with CASP
Section E: Steps in Processing Batteries with CASP
Section G: Step-by-Step CASP Operation

A-2 THE PROGRAMMER'S MANUAL

Your facility should designate someone familiar with the operation and care of battery powered and DC powered equipment to be responsible for updating the programmed values in your CASP's computer user tables. This authorized person can use the CASP Programmer's Manual to access CASP's internal computer user tables employing the PROGRAMMER PASSWORD.

Both manuals are arranged to help you find the information you need. Each has an index, lists of figures and a table of contents.

A-3 NOTICE

The example settings and tables are based upon the standard 42 volt CASP and are not necessarily appropriate for other models. See appendix III under the section for your specific unit for limitations and ratings.

SECTION B
HOW YOUR FACILITY CAN USE CASP

B-1 CASP FACILITY USE DIAGRAMS

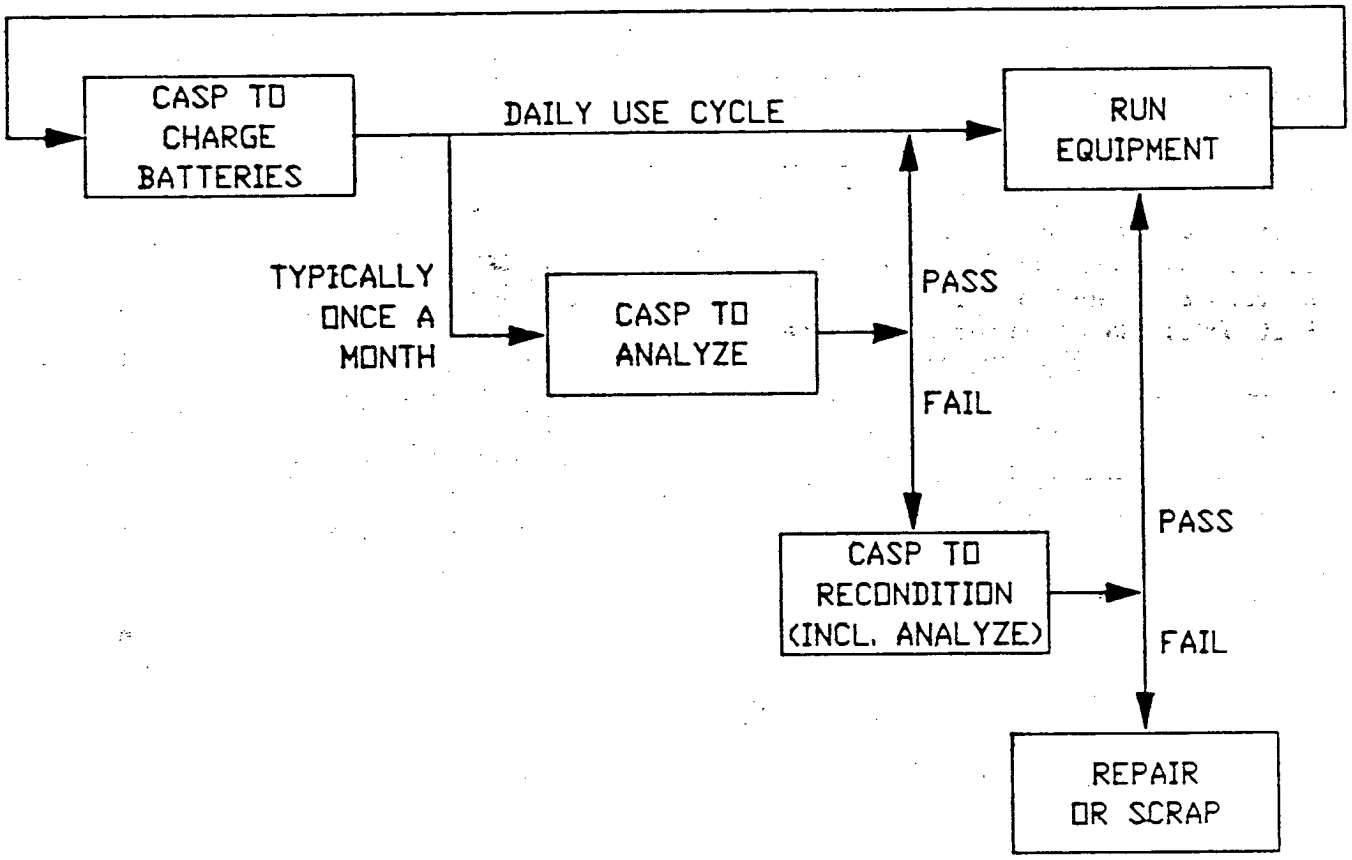


FIGURE 1 BLOCK DIAGRAM OF BATTERY USE CYCLE

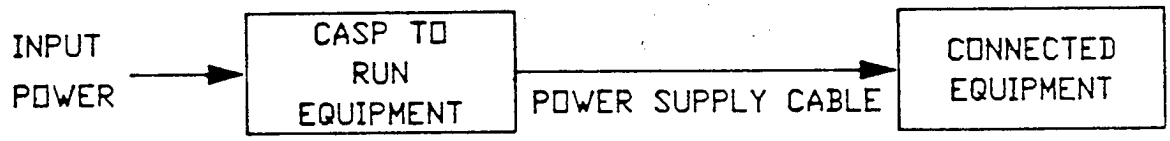


FIGURE 2 BLOCK DIAGRAM OF CASP USED AS A POWER SUPPLY

FIGURE 1 shows the suggested use cycles of CASP at a typical facility, while FIGURE 2 shows it used as a power supply.

The CASPs used to analyze, the CASPs used to recondition, and any CASPs used as DC power supplies (FIGURE 2) may be separate units, or one unit may serve these many purposes--depending on the needs of your facility. Batteries would be used to run equipment, then recharged on a daily basis. Once a month they would be taken out of that circulation for analysis, and reconditioning, if indicated.

B-2 CASP'S CUSTOM PRE-PROGRAMMING

Parameters believed correct for battery types commonly used in your industry may have been pre-programmed into your CASP's memory tables. If so, they are given in the computer print-out located in the back pocket of this manual (See Para. H-2). Alternately, you can view them by entering the letter "I" for "Inspection" by pressing the GREEN "UP" SHIFT and the letter "I" (See Para. H-3).

For the television industry for instance, these could include: Christie and non-Christie ni-cad packs of 10 D cells for VCRs, packs of 12 D cells for cameras, packs of 24 F cells for thirty volt lighting.

Since such a great variety of battery types, sizes and makes is available, do not rely on the pre-programmed parameters without close monitoring throughout at least your first use for excessive battery heating or venting, abnormal loss of electrolyte, bulging, or other faulty signs warnings of potential battery damage, or even its violent failure. If any faulty signs are observed, press the green "up" shift key, and then the red "stop" key. Move personnel a safe distance away. Once proven successful, the pre-programmed parameters can be adopted.

Your facility should designate someone familiar with the operation and use of battery powered and DC powered equipment to be responsible for updating the programmed values in your CASP's computer tables. That person will have the PROGRAMMER PASSWORD code and the CASP Programmer's Manual to help in reprogramming the user tables in your CASP for improved performance or to handle any new battery types.

SECTION C
GETTING ACQUAINTED WITH CASP

CASP is one of the few things in your life which should never become out-dated. It is adaptable enough to charge, analyze and recondition any present rechargeable battery or any rechargeable battery of the future. To remain versatile, CASP has a fully user programmable microcomputer. That makes CASP sound pretty complicated.

The truth is--once CASP is properly programmed to service all of your batteries--you usually don't even need to press any keys in its day-to-day use. You just plug in and unplug batteries. Sometimes it requires the pressing of one or two keys. CASP's screen tells you which batteries are charged and ready to put to work. It couldn't be easier to use!

C-1. CASP'S CAPABILITIES

CASP's microcomputer control module is its heart. Its color-coded keys enable you to program CASP to:

-- automatically service up to six batteries of intermixed types and sizes

-- ultra-fast charge CHRISTIE reFLEX batteries in 15 to 20 minutes (maximum) and fast charge many others in 30 minutes to 2 hours

The CASP 1H will take longer to charge due to the reduced ouput current. Most reFLEX batteries will take from 25 to 30 minutes on ultra fast charge and fast 30 minutes to 2 hours.

-- slow charge up to six batteries in sequence or simultaneously

-- discharge batteries for shipment or storage

-- analyze and display battery ampere-hour capacity or equipment operation time

-- recondition batteries

-- function as a programmable power supply with six parallel outputs

C-2. CASP's Ratings

C-2.1 CASP POWER INPUT

CASP can be operated from power mains anywhere in the world. The AC module accepts AC power input ranging from 90 to 130 and 180 to 265 volts, 47 to 440 HZ. No adjustments, such as switching or reconnection, are needed to function within this range, as CASP's internal programming senses the input voltage and sets itself correctly. The CASP-end of your power cord is an internationally standard plug. All you need to move your CASP from one country to another is the appropriate power cord for that country.

C-2.2 CHARGING AND POWER SUPPLY OUTPUT

0 to 42 volts DC, 0 to 14 amps DC, not to exceed 350 watts. See appendix III for details.

C-3.1 MICROCOMPUTER CONTROL MODULE

The front panel contains color-coded control keys and a liquid crystal display (LCD) screen.

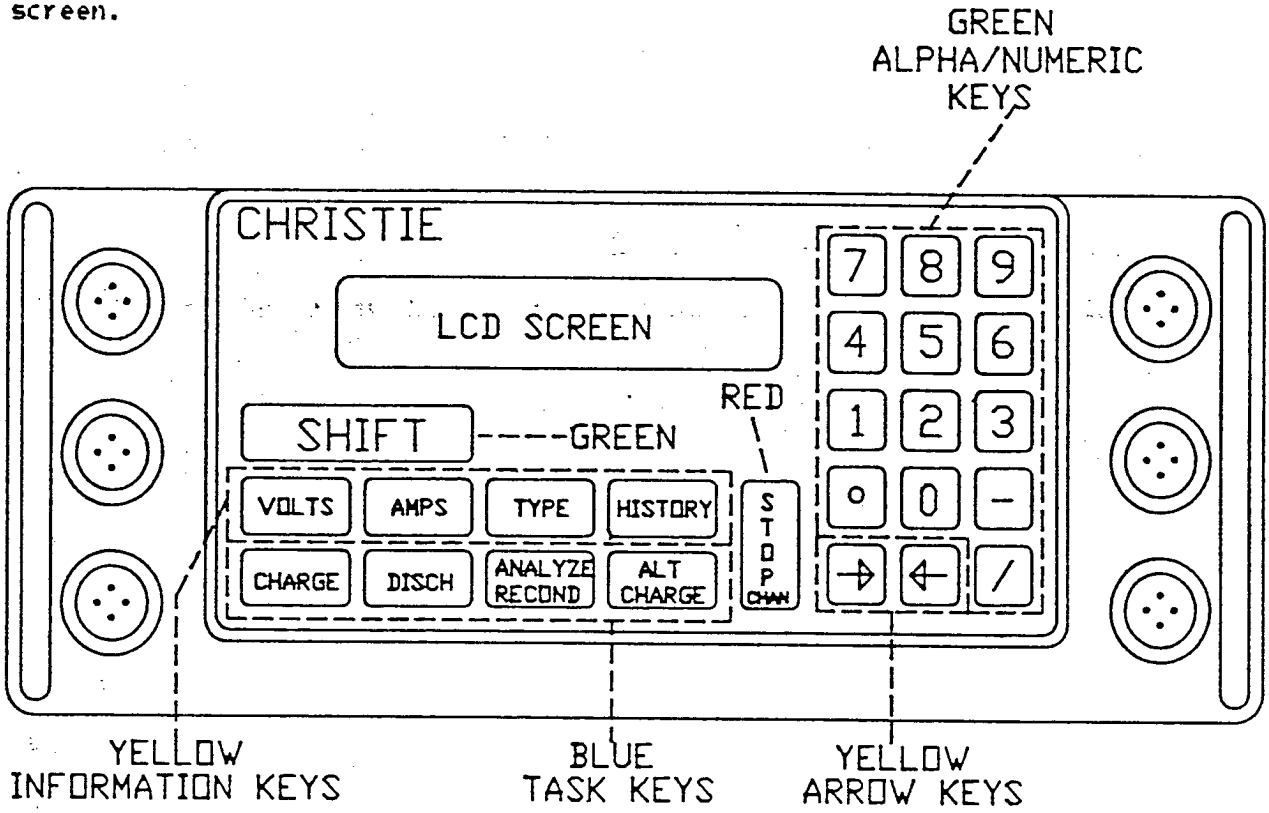


FIGURE 3 Microcomputer Control Module, Front Panel

FIGURE 3 shows the front panel with the six numbered output channels to which as many as six batteries of intermixed types and sizes may be connected by battery charging output cables for processing. Replacing battery charging output cables with power supply output cables, and placing CASP in the power supply mode, enables CASP to be used to power DC operated equipment. Each channel has a four-pin cable connector.

The LCD SCREEN displays various battery diagnostic data, power supply information, as well as information to operate or to program CASP.

When you correctly activate any CASP keys, you will hear a reassuring "beep" after they have been pressed. Activation of an inappropriate CASP key may result in another tone, and an error message on the CASP LCD screen.

The detailed functioning of all CASP keys is described in the KEYBOARD REFERENCE SECTION, Section G.

C-3.1.1 THE BLUE KEYS

The BLUE TASK KEYS initiate one of the various battery functions CASP can perform on each of the six channels, in turn. The use of each BLUE key is described in BLUE TASK KEYS, Para. G-5.

C-3.1.2 THE YELLOW KEYS

The YELLOW INFORMATION KEYS cause the LCD screen to display output data and data about batteries and cables connected to each of the six channels. Detailed functioning of these keys is described in YELLOW INFORMATION KEYS, Para. G-4.

The YELLOW ARROW KEYS are used to step through the data display for each channel. Press the RIGHT ARROW KEY to step through the channels from 1 through 6, and back to channel 1 from 6. The LEFT ARROW KEY steps in the opposite order. The YELLOW ARROW KEYS are detailed in Para. G-3.

C-3.1.3 THE RED KEY

The RED "STOP CHAN" KEY halts the battery function begun with a BLUE TASK KEY and moves that same activity to the next higher numbered channel to which a battery is connected, and which has not completed its processing. See Para. G-1. If you were on Channel 6, this key moves you back to Channel 1.

When the GREEN "UP" SHIFT KEY (see below) is pressed followed by pressing the RED "STOP CHAN" KEY, it stops activity on all of the channels at once.

If necessary to halt activity, these two steps may be repeated.

C-3.1.4 THE GREEN KEYS

The GREEN ALPHA-NUMERIC KEYS are used to give commands such as the one turning CASP into a power supply or to print the LCD display. The ALPHA-NUMERIC KEYS are used in conjunction with the GREEN SHIFT KEY to enter both numbers and letters.

The GREEN "UP" or "DN" SHIFT KEY used before another key (BLUE, YELLOW, RED or GREEN ALPHA-NUMERIC) enables the second key to perform as many as three separate functions. The selected key performs one function when it is used alone; another when used after pressing the "UP" end of the SHIFT KEY; a third function when used following pressing the "DOWN" end of the SHIFT KEY. It functions much like the shift key on a standard typewriter keyboard, except that the CASP shift key is pressed before the other key (not simultaneously), and that there are two shift keys (rather than one). Further details are in Para. G-2.

To shift "UP" or "DN", first press the appropriate end of the SHIFT KEY. You should hear a "beep". Then press the BLUE, YELLOW, RED or GREEN key which performs the "SHIFT" function you desire. You should hear a second "beep" tone.

"3" KEY:Enters the numeral "3"

"UP" followed by "3" KEY: Enters the letter "I"

NOTE: an operator will need to use the letter "I" when he wishes to inspect the programmed values in the various user tables of the CASP computer.

"DN" followed by "3" KEY: Enters the letter "V"

NOTE: an operator will need to use the letter "V" when he wishes to place CASP into the power supply mode.

C-3.2 POWER INPUT MODULE

The rear portion of your CASP is an AC input power module (or optionally, a DC input power module). It is fully controlled by the microcomputer control module, which is plugged into and clamped to it.

The diagram shows the features of the AC input power module back panel.

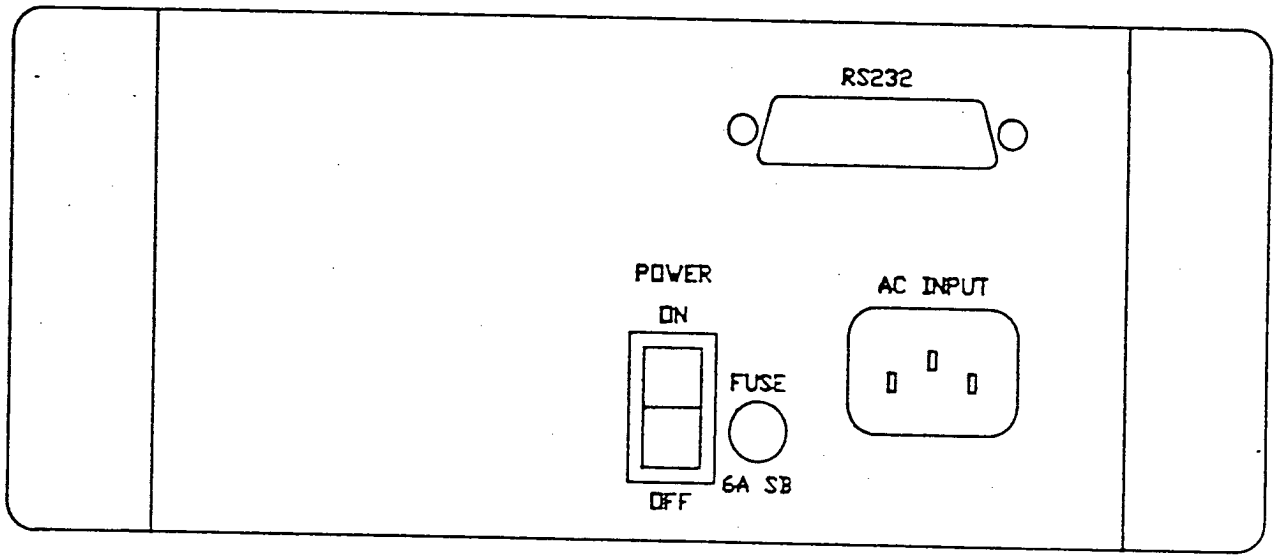


FIGURE 4 AC Input Power Module, Back Panel

The AC Input receptacle accepts an international standard plug. The RS232 serial I/O computer port allows your CASP to print-out results of its analyses to a compatible computer printer (such as the Okidata ML92S). (See also, Para. C-3.4., Optional CASP Equipment.) It can also receive data from a compatible computer (such as an Apple IIe) or from a compatible bar code reader.

C-3.3 OUTPUT CABLES

CASP comes supplied with six output cables of your facility's choice. They may be any combination of battery cables or power supply cables.

Each battery cable is marked with a number between 100 and 131. Battery cables come two ways: with a battery connector, or with color-coded leads.

If a battery cable has color-coded leads, red indicates plus (+), black is minus (-). If there is a third lead, it is blue. It will connect to a compatible battery temperature sensing terminal. If the battery has no such terminal, connect the blue lead to the red lead.

Power supply cables are marked P/S or 098. Power supply cables have two bare leads, or alligator clips. Again red is plus (+) and black is minus (-). Power supply cables must NEVER be used to connect CASP to batteries.

C-3.4 OPTIONAL EQUIPMENT

C-3.4.1 DISCHARGE BOOSTERS

External regulated discharge boosters are available which increase CASP's discharging capabilities beyond its rated 4 amps (not to exceed 60 watts). A maximum of two may be connected to a CASP at one time, increasing the discharge capability to 14 amps or 480 watts.

C-3.4.2 HIGH VOLTAGE OPTION

Another second power module is available to allow charging of higher voltage batteries of up to 43 cells. The maximum output current is reduced, but all other features of the standard CASP are available.
The 1H module is available as a replacement for the standard AC input module.

C- 3.4.3 DC INPUT MODULE

Another input power supply module is available, one that accepts DC power input from 10.5 to 36 volts DC. No extra adjustments are needed to function within this range, as CASP's internal programming senses the input voltage and sets itself correctly. This wide range, together with its portability, enables CASP to be easily used in an automobile, boat, aircraft or with a battery supply. The DC module allows CASP to be used as a DC to DC converter with stable output, in addition to as a DC powered universal battery charger.

The DC input module is available as a replacement for the AC input module.

C-3.4.4 PORTABLE PRINTER

A thermal CHRISTIE portable printer fits between the microcomputer (front) module and the input power (rear) module.

SECTION D
UNDERSTANDING PROCESSING BATTERIES WITH CASP

D-1 SUMMARY OF PROCESSING

As many as six batteries of differing types and sizes may be connected to your CASP for a particular kind of processing (such as charging). The initial programs normally provided in your CASP's memory apply to nickel-cadmium, silver-zinc and lead-acid batteries.

Each battery type has its own specific cable. Your CASP is furnished with six cables of your selection, for processing any combination of battery types. Each battery cable can be connected to any of the six output channels. Included, if you wish, can be the special power cable for connection to equipment when CASP is in the power supply mode.

Once CASP's computer is programmed properly for a battery type, the cable is recognized by the identification built into it. This is called the cable's "ID". When CASP senses a cable connected, it checks the cable "ID", makes a rough test of the impedance (or equivalent resistance) of the connected battery, and is ready to run any of the possible battery processes stored in its memory (programs) for that "ID".

Testing for verification of the match among the battery, cable and internal program is the first step in any use of CASP--NOT TO BE SKIPPED. (See "Inspection" function in Section H.)

The BLUE TASK KEYS (see Para. G-5 in the KEYBOARD REFERENCE SECTION) are used to select a process for CASP to perform. CASP performs this service on each of the six channels, stepping from one to the next. It repeats until that same process is completed on all the batteries connected to the six channels. If processing a particular channel is completed or no battery is connected, CASP skips that channel and continues to the next one.

The LCD screen displays the progress of the selected processing. Further checks to doubly verify that the appropriate program is being used should be made during processing. They include touching the battery to detect any excess heating, observing it for signs of abnormal gassing ,loss of electrolyte, bulging or other faulty signs checking the battery voltage by pressing the YELLOW "VOLTS" KEY and checking the current being applied for appropriateness by pressing the YELLOW "AMPS" KEY.

When one channel's processing has completed, CASP gives an audible signal to alert the operator and briefly displays the end result of processing on that channel. Then it stores the result of processing information in its "history" file, so that it may be examined ("called up") on the screen later with the YELLOW "HISTORY" KEY.

Once processing of all connected batteries is completed, a "SUMMARY SCREEN" (See Appendix I, SUMMARY SCREEN REFERENCE SECTION) on the LCD displays the results of processing for all channels. The operator can tell at a glance on which channels

processing has completed successfully, and on which channels there are batteries needing attention.

D-2 CHECKING THE BATTERY/CABLE/PROGRAM MATCH IS VITAL

D-2.1 CASP'S OWN TEST

Upon activation of the BLUE "CHARGE", "DISCHARGE" or "ANALYZE/RECOND" KEY, and at regular intervals thereafter, CASP performs short "rail" tests of the impedance (equivalent resistance) of each connected battery. It compares the voltage during this test with the "rail" value (the maximum voltage expected) which is entered into the SHARED PARAMETER TABLE 090-093 in the computer, (see Para. DD-2. in the CASP Programmer's Manual).

If the voltage is within 95% of the programmed value during any of these "rail" tests, the battery is immediately rejected by CASP. When processing terminates, an error message of "Op*" is displayed on the screen when the YELLOW "HISTORY" KEY is used for that channel. Other reasons CASP might reject processing a channel are: an open circuit exists; a short circuit; battery still too hot from prior use; or connection with reverse polarity. If any of these conditions occur, CASP will display an error message.

D-2.2 OPERATOR CHECKS

The following three checks must be done on each channel before CASP is used for any of its processes.

First, you check the cable number to be sure it matches the numerals on the cable itself. The YELLOW "TYPE" KEY is pressed after the GREEN "UP" SHIFT KEY to test this for each channel. (See Para. G-4.3., "TYPE" KEY).

Next, you press the YELLOW "TYPE" KEY alone to be sure that you and CASP agree on the kind of battery connected to the selected channel, its rated ampere-hours, its nominal voltage and its number of cells.

The GREEN "UP" SHIFT KEY and then the "3" KEY is used for the letter "I" which places CASP into the "Inspection" mode. This allows checking the user computer program with which CASP will be processing the battery. The YELLOW ARROW KEYS are used to step from one parameter entry to the next. Check especially to be sure the voltage and current parameter setting CASP is planning to use are appropriate for the connected battery.

Further checks are to be made after the selected process has begun. They are described in Section E, STEPS IN CHARGING BATTERIES WITH CASP.

SECTION E
STEPS IN PROCESSING BATTERIES WITH CASP

This description assumes that your CASP is already properly programmed for the batteries to be processed. If you have not previously processed the type of battery connected, or are using a previously untried process, be sure to monitor the battery for the entire processing time for excessive heating, abnormal venting of gases or other faulty signs. SEE WARNINGS AT BEGINNING OF THIS MANUAL.

WARNING: IN CASE OF EXCESSIVE HEATING OR VENTING, ABNORMAL LOSS OF ELECTROLYTE OR BULGING OR OTHER FAULTY SIGNS, PRESS THE GREEN "UP" SHIFT KEY FOLLOWED BY THE RED "STOP CHAN" KEY. HAVE EVERYONE LEAVE THE VICINITY OF THE BATTERY IMMEDIATELY. HAVE THEM STAY AWAY UNTIL THE BATTERY HAS COOLED DOWN.

Further use and function descriptions of the various CASP keys may be found in the KEYBOARD REFERENCE SECTION, Section G.

E-1. GETTING CASP READY FOR BATTERY PROCESSING

-- Plug the CASP end of the power cord into the AC input socket.

-- Plug the other end of the power cord into the wall.

-- Connect the cables for the batteries to be processed to the CASP channels. Hold the white dot upwards while plugging the cable into the channel connector. (NOTE: The white dot is a time saver; the connectors are keyed and cannot be plugged in incorrectly.)

-- Connect the correct battery to each cable.

-- Turn on the power switch.

-- When you are examining the BATTERY/CABLE/PROGRAM match, press the YELLOW ARROW KEYS to access one channel after another. See Para. C-3.1., Microcomputer Control Module, for the location of any CASP keys.

-- When you are ready to process, press the GREEN "UP" SHIFT KEY and then the RED "STOP CHAN" KEY.

E- 3. CHECKING THE BATTERY/CABLE/PROGRAM MATCH

-- Press the GREEN "UP" SHIFT KEY followed by the YELLOW "TYPE" KEY. The displayed cable number should match the numerals on the actual cable between that battery and your CASP. Repeat this step for each channel you are using, stepping through them with the YELLOW ARROW KEYS. (See Para. G-2., describing the use of the GREEN SHIFT KEY).

-- Press the YELLOW "TYPE" KEY. Be sure the LCD screen reads that the battery connected matches the actual battery on the other end of the cable: channel number, name, ampere hour rating, number of cells and voltage rating. Repeat this step for each channel you are using to charge batteries, stepping through them with the YELLOW ARROW KEYS.

-- Enter the letter "I" ("UP" followed by "3") to read the computer program being utilized to charge each battery. Look especially at the current values and the charge codes with which CASP is planning to process the battery. They must be appropriate for the battery connected.

E-4. PROCESSING THE BATTERY

-- See Section F, BATTERY PROCESSING REFERENCE SECTION, for details on each of CASP's processes, when to use them, and types of batteries which can be processed with each of them.

E-5. CHECKING DURING PROCESSING

-- If practical, check the batteries several times during processing:

Touch each battery to verify that it is not heating excessively during charge (less than 20 degree centigrade rise). A greater temperature rise is acceptable during discharge, providing the battery is allowed to cool before charging begins.

Look for signs of loss of electrolyte or excessive venting of gas.

(See WARNING on page 1, following title page)

NOTE: Some batteries normally vent a little during charging, especially types such as vented aircraft batteries.

-- Press the YELLOW "VOLTS" KEY and the YELLOW "AMPS" KEY to see that the readings are appropriate for the battery being processed.

E-6. CHECKING AFTER PROCESSING

-- At the conclusion of processing on all six channels CASP will "beep" and display a screen summarizing the results (See APPENDIX I, SUMMARY SCREENS).

-- On the top line of this SUMMARY SCREEN, it tells the channel numbers with batteries attached which have completed processing. Processing details (such as time, ampere-hours) for successfully serviced batteries may be found using the YELLOW "HISTORY" KEY then the YELLOW ARROW KEYS, or the GREEN channel number key followed by the "HISTORY" key. (See para. G-4.4. for a description of the "HISTORY" key messages.)

-- The channel numbers on the second line of the SUMMARY SCREEN have batteries connected which have experienced interruption of their processing or a problem in processing. To determine exactly what went wrong, access the channel history as above.

-- Having unplugged some batteries, you can now start the same process with new batteries, simply by plugging in more batteries for processing and running the checks above on the new batteries.

(NOTE: You could also unplug any battery and connect a new one while CASP is processing on other channels.)

-- If you wish to turn CASP off, retaining the information on the currently connected batteries in the "HISTORY" KEY's file, unplug the power cord from the AC input, leaving the batteries connected.

(NOTE: This also saves the "HISTORY" file during a power failure.)

-- Or you could turn CASP off at the power switch. This erases any information in the YELLOW "HISTORY" KEY's file.

(NOTE: If you turned CASP off accidentally at the power switch, you can bring back the "HISTORY" KEY's file of information about connected batteries by pressing the YELLOW "HISTORY" KEY WHILE switching the unit back on.)

SECTION F
BATTERY PROCESSING REFERENCE SECTION

F-1. OVERVIEW OF CASP PROCESSING

When you press any of the BLUE TASK KEYS (with or without pressing a shifted function), CASP will activate a particular battery processing schedule. Each processing mode, cutoff method and the values of that schedule will be in accordance with CASP's pre-programmed computer user tables for the particular cable connected to that channel. (Each cable is dedicated to the processing of a particular battery type.) This section first summarizes and then describes these automatic processing modes and categories.

"CHARGE" KEY MODES (Paragraph F-2)

-- reFLEX Charging
-- Constant Current Charging
-- Constant Potential Charging

"CHARGE" KEY CUTOFF METHODS (Paragraph F-3)

-- Computer - Standard
-- Computer - Maximum
-- Timed
-- Voltage
-- Temperature
-- Voltage Triggered Time

"ALT CHARGE" KEY MODE AND CUTOFF (Paragraph F-4)

-- Sequential slow constant current charge with timed cutoff
-- Near-simultaneous Constant Current Charge with timed Cutoff

"DISCHARGE" KEY MODE AND CUTOFF (Paragraph F-5)

-- Constant Current Discharge with Voltage Cutoff

"ANALYZE/RECOND" KEY MODES AND CUTOFFS (Paragraph F-6)

NOTE: The individual cycles of modes and cutoffs here are the same ones obtained by pressing the YELLOW "CHARGE" KEY and the "DISCHARGE" KEY.

-- " ANALYZE": "Discharge", then "Charge" (for analyzing or charging)
-- "^ ANALYZE": "Charge", then "Discharge", then "Charge" (for analyzing)
-- "v ANALYZE": "Discharge", then "Charge", repeated three times (for reconditioning)

F-2. "CHARGE" KEY MODES AVAILABLE WITH CASP

"CHARGE" KEY charging is the normal way to charge and will be used most of the time. reFLEX charging, constant current and constant potential charging are all "CHARGE" KEY charge modes.

F-2.1. reFLEX CHARGE MODE

CHRISTIE's reFLEX charging process enables CHRISTIE's own nickel-cadmium batteries to be recharged in 20 minutes or less, and other types in a longer period of time. CASP is normally preset to reFLEX charge all ni-cad batteries, but your programmer can alter this setting. With reFLEX charging batteries can often be charged to a higher-than-rated capacity, stay cooler, have less cell imbalance and have a minimum of "memory" (an apparent loss of capacity).

In reFLEX charging a high charge (positive) pulse is followed by a lower energy discharge (negative) "burp" pulse. reFLEX charging is similar to the alternate feeding and burping of a baby. The reFLEX (negative) pulse burps the battery to get rid of excess gases. This raises the charging efficiency so greatly that more of the charging energy goes into the battery instead of into heat.

When charging ni-cads, the last 15 % of the battery's capacity before it is fully charged is the most important. During this portion of the charging process, low current can cause insufficient capacity, "memory" problems and cell imbalance. High currents cause overheating, lowering the battery's charge acceptance. ReFLEX charging overcomes these problems with high currents, yet very little rise in temperature. This enables reFLEX charging to provide typically 90-97% charging efficiency, compared to only 65-70% efficiency of conventional charge methods.

CASP can reFLEX charge most Ni-Cad battery types other than CHRISTIE's own. These non-CHRISTIE batteries are reFLEX charged at a lower current than their corresponding CHRISTIE batteries, making the charging time longer. In these cases, CASP typically uses approximately the same charge current as their manufacturer's fast chargers.

NOTE: The programmed charge current value is not only limited by the type of cell being processed and the degree of cell matching, but also by the internal wiring and connectors.

CHRISTIE reFLEX-20 batteries, for instance, take a maximum of 15 to 20 minutes each to charge, whereas other makes of Ni-Cads are reFLEX charged for 30 to 120 minutes each to reach full charge.

CASP's reFLEX charging operates best with certain charge cutoff categories discussed below.

TYPICAL TYPES OF BATTERIES: Most ni-cads

F-2.2. CONSTANT CURRENT CHARGE MODE

The battery is charged at one or two levels of a regulated constant current throughout processing. At the end of this mode CASP will turn off.

TYPICAL TYPES OF BATTERIES: Silver-zinc (MUST USE VOLTAGE CUTOFF)
Alternate for some lead-acid

F-2.3 CONSTANT POTENTIAL CHARGE MODE

The battery is charged at a regulated constant potential throughout processing -- the number of volts used is held steady. This type of charging will cause the current to taper from a high value (as programmed) when fully discharged, to a lower value at the end of this charge mode.

TYPICAL TYPES OF BATTERIES: Lead-acid

F-3. "CHARGE" KEY CUTOFF METHODS

Each "CHARGE" KEY charging program in the CASP user tables identifies a charge termination (or cutoff) method. Several of these cutoffs have one or more "backup" or secondary cutoff methods. There are eleven combinations of charge modes and cutoff schemes, called Charge Categories A through L.

EXAMPLE: Charge mode and Cutoff Combination "A" (usually used on sealed ni-cad batteries) uses reFLEX charging and "standard" computer charge termination (See FIGURE 5) as the primary cutoff, while "maximum" computer termination acts as a first "backup". Battery temperature acts as a second "backup" for batteries so equipped. An additional "backup" is a pre-programmed maximum time of charging.

F-3.1. "CHARGE" KEY CHARGING AND CUTOFF COMBINATIONS *

CHARGING METHOD	PRIMARY CHARGE CUTOFF METHOD					
	CHARGE CURVE		TIMED	VOLTAGE	TEMPERATURE (TCO)	VOLTAGE TRIGGERED TIME
	STANDARD	MAXIMUM				
reFLEX	A	B	L	--	--	I
Constant Current	J	K	C	D	E or F	H
Constant Potential	--	--	G	--	--	--

* Combinations H and I are not available in Version 4.4 of CASP software, but will be available in future versions.

FIGURE 5 Charge and Cutoff Method Combinations

F-3.2. CHARGE CUTOFF METHODS

"STANDARD" COMPUTER CUTOFF (Categories A & J)

This cutoff method uses a proprietary, computer generated, state-of-charge signal to determine when to end the charging process. Unless the "MAXIMUM" computer cutoff (below) gives consistently better and safe results, this category is recommended for most CHRISTIE and non-CHRISTIE sealed cell battery packs. The "MAXIMUM" cutoff signal acts as a first backup in this category. If the battery has a compatible third wire, temperature sensing (TCO) terminal, this signal acts as a second backup. An additional backup is a pre-programmed maximum time of charging ("Charge Time").

TYPICAL TYPES OF BATTERIES: Sealed ni-cads

"MAXIMUM" COMPUTER CUTOFF (Categories B & K)

This cutoff method uses a proprietary, computer generated, state-of-charge signal to determine when to end the charging process. Category B is recommended only for battery packs with low impedance (equivalent resistance) sealed ni-cad cells which are balanced for ampere-hour capacity and charging efficiency. K is used for some sealed lead-acid packs. Use B only if it is found to be consistently better and safer than the "STANDARD" computer cutoff. If the battery

has a third wire, temperature sensing (TCO) terminal, this signal acts as a backup cutoff. An additional backup is a pre-programmed maximum time of charging ("Charge Time").

TYPICAL TYPES OF BATTERIES: Alternate for sealed ni-cads
and some sealed lead-acid

TIMED CUTOFF (Categories L, C & G)

Charging is terminated when the battery has been charged for a predetermined period of time. The timed cutoff is typically at 4, 7, 8 or 14 hours.

TYPICAL TYPES OF BATTERIES: Lead-acid or vented nickel-cadmium

VOLTAGE TRIGGERED, TIMED CUTOFF (Categories H & I)

In this category termination of charging occurs when a preprogrammed period of time has elapsed after a pre-programmed voltage level has been reached. This category may be used if the "STANDARD" or "MAXIMUM" cutoff is not practical.

TYPICAL TYPES OF BATTERIES: Nickel-iron
Alternate for ni-cads

VOLTAGE CUTOFF (Category D)

In this category the battery is charged to the pre-programmed voltage level. The first time the cutoff voltage value is reached, the current value drops to one half of the initial value and charging continues at that level. The second time the cutoff voltage is reached, the charging process terminates.

TYPICAL TYPES OF BATTERIES: Silver-zinc

TEMPERATURE CUTOFF (TCO) (Category E & F)

Some batteries have a third terminal and temperature sensing circuitry. In Category E, this third wire cutoff signal is used as the primary signal in terminating the charging process. However, it is likely to shorten the life of a battery by purposely heating it. This method is, therefore, recommended only if one of the other cutoffs does not provide satisfactory results.

Category F is the same as E except that it includes K as a backup.

TYPICAL TYPES OF BATTERIES: Alternate for batteries having third wire (TCO) terminal

F-4. "ALT CHARGE" KEY MODE AND CUTOFF

This key is used for sequentially slow charging several batteries. Or they may be nearly simultaneously slow charged. Slow charging of ni-cads is recommended when:

- You have a new ni-cad pack
- Your pack has been in storage for many months
- You believe your pack may have badly unbalanced cells
- You are charging high impedance or consumer grade packs
- The screen shows a "-" during reflex charging

F-4.1. SEQUENTIAL SLOW CHARGING: ("ALT CHARGE" KEY)

This alternative to the standard charging methods processes batteries slowly, one channel after another, typically taking 14 to 16 hours for each battery. In this case, it is a constant current charge at one tenth the amp-hour capacity of the battery (C/10), with a 14 or 16 hour timed cutoff. It is initiated with the BLUE "ALT CHARGE" KEY alone.

If six batteries are connected, each taking 16 hours to charge--all six will be charged in 96 hours (16 hours x 6 = 96 hours).

F-4.2. "SIMULTANEOUS" SLOW CHARGING: ("^ ALT CHARGE" KEY)

"Simultaneous" slow charging with timed cutoff is an alternative to sequential constant current charging. This nearly simultaneous method enables you to slow charge six batteries in about 16 hours, instead of 96 hours. It is initiated with the GREEN "UP" SHIFT KEY followed by the BLUE "ALT CHARGE" KEY.

During "simultaneous" charging, the reading on CASP's ammeter (YELLOW "AMPS" KEY) will be six times the programmed "ALT CHARGE" amp value, but it is applied for only ten seconds at a time.

WARNING: "ALT CHARGE " and "^ ALT CHARGE" SHOULD NEVER BE USED ON SILVER-ZINC BATTERIES. Low rate current should be set to 0.00 amps as a precaution.

F-5. "DISCH" KEY MODE AND CUTOFF

CASP's BLUE "DISCH" KEY enables you to discharge batteries at constant current to some value referred to as full discharge (typically 1 volt per cell for ni-cads, 1.8 volts for lead-acid, and 1.1 volts for silver-zinc, as pre-programmed into your SHARED PARAMETER TABLES 090-093, Para. H-3.4). If your battery has 20 cells, and 1 volt per cell is the discharge standard, CASP will discharge it to 20 volts.

This full discharge cycle is useful, for instance, when you want to ship batteries safely to another location.

Your CASP's maximum discharge rate of 4 amps (not to exceed 60 watts) can be augmented by one or two optional external regulated discharge boosters, each offering 6 amp discharge, not to exceed 210 watts. Thus, if needed, your CASP's total discharge could be boosted to 14 (not 16, this is the wiring and fuse limit) amps, 480 watts, with two of these external devices, (Model CDC-60).

F-6. "ANALYZE/RECOND" KEY MODES AND CUTOFFS

For many years, the state of charge and the condition of full charge in lead-acid batteries was determined with a hydrometer which measures the specific gravity of the liquid electrolyte. However, in nickel-cadmium and silver-zinc batteries, specific gravity does not change with charge or discharge. Furthermore, it is not practical to use a hydrometer with sealed, starved or jelled lead-acid batteries. With all these types, discharge tests have become the means of determining the battery's output capacity.

The use of one of CASP's analyze cycles will provide you with a read-out of battery ampere-hours or of the length of time the battery can power your equipment with a certain current draw. These cycles can be used about once a month (or after a certain number of hours in service) as a regular maintenance check. (See Section B).

F-6.1. "^ANALYZE": "UP" SHIFT + "ANALYZE RECOND" KEY MEASURING DISCHARGE AMPERE-HOUR CAPACITY

The Analyze 2 cycle consists of a "Charge" plus a "Discharge" plus a "Recharge". The first charge is to bring the battery to its maximum capacity state in order to ready the battery for the discharge capacity analysis. The recharge following the discharge test prepares the battery for normal use. This cycle is obtained by first pressing the GREEN "UP" SHIFT KEY and then the BLUE "ANALYZE/RECOND" KEY.

The initial charge and the recharge are performed by whatever standard charging method is programmed for that cable and battery to be used when the BLUE "CHARGE" KEY is pressed. Then CASP's discharge cycle brings it to the level defined as fully discharged (See Para. F-5), measuring its discharge ampere-hour capacity in the process. Then it charges the battery again so it's ready for use.

During either charging portion of the ANALYZE 2 method, the CASP LCD screen indicates the type of charging method being applied by the CASP programming (Ref, CC, TCO, CP) and the amount of processing time elapsed. At the conclusion it displays the discharge (D) amp-hours (AH) and the time it took.

The constant current used to test ni-cad discharge capacity is usually the one- (C) or two-hour (C/2) rate. For example, a battery rated at 4 AH would be discharged at 4 amps or 2 amps, respectively. The two-hour rate is recommended to prevent battery heating.

A 4 amp-hour battery should take two hours to discharge fully at a constant current of 2 amps. If it took less than two hours, the battery is not up to the rated capacity. If it took two and one half hours to discharge the battery, it has 5 amp-hours of capacity--more than its rated capacity.

One of the advantages of CASP's programmable processing is that this test can be run at the current drawn by your equipment, so that the discharge time reading at the conclusion of processing will directly tell you how long that battery will operate your equipment, with no further calculation necessary. For instance, if you use a particular battery pack to operate a television camera that draws 3.25 amps, your discharge capacity test can be programmed at that rate, and the reading will tell you how many hours that pack will operate that camera, in addition to the battery's ampere-hours.

F-6.2. "ANALYZE": "ANALYZE/RECOND" KEY MEASURING CHARGE AMPERE-HOUR CAPACITY

The three separate processes in the ANALYZE cycle take time. When time is more important than accuracy, CASP's "ANALYZE" method can be utilized to provide an approximation of battery capacity.

ANALYZE measures the amount of ampere-hours it takes to charge the battery, rather than the discharge ampere-hour capacity. This abbreviated analysis is practical with CASP because reFLEX charging and accurate computer turn-off improves the charging efficiency of low impedance Ni-Cad batteries to typicaly over 90%. Charging capacity can therefore be closely related to discharge capacity for such a battery using CASP. This cycle is obtained by pressing the blue ANALYZE/RECOND key alone.

The battery is first constant current discharged to the level defined as fully discharged (See Para. F-5). Then it is recharged applying whatever "standard" charging method is programmed for that particular cable and battery when the BLUE "CHARGE" KEY is pressed. The time it takes to charge the battery using its standard charge method is displayed, as well as the charge (C) amp-hour (AH) capacity rating.

F-6.3. "ANALYZE": "ANALYZE/RECOND" KEY AN OPTIONAL CHARGING METHOD

This process may be used by those wishing to discharge batteries before they are recharged. It uses constant current to discharge the battery. Then in recharging, it uses whatever "standard" charge method has been programmed for the cable being used (See Paragraph F-2 and F-3, above). This process is initiated by pressing the BLUE "ANALYZE/RECOND" KEY.

Using this method for charging batteries on a regular basis, not just for analyzing them, is unnecessary with CASP. Not only will processing take longer, but it will also shorten the battery life cycle substantially. CASP's "standard" charging methods monitor the state of charge throughout and terminate the charging process more appropriately.

This method may help ni-cad batteries with "memory" problems, however the RECONDITION process will help this problem without shortening battery life significantly.

F-6.4. "v ANALYZE": "DN" SHIFT + "ANALYZE/RECOND" KEY RECONDITIONING NI-CADS

Ni-cad batteries are subject to capacity fading due to "memory". Such a battery is seemingly, but not actually, fully charged. It will be unable to deliver full capacity with use. This "memory" phenomenon is typically caused by trickle charge, shallow (partial) discharge, incomplete charge or constant potential charge.

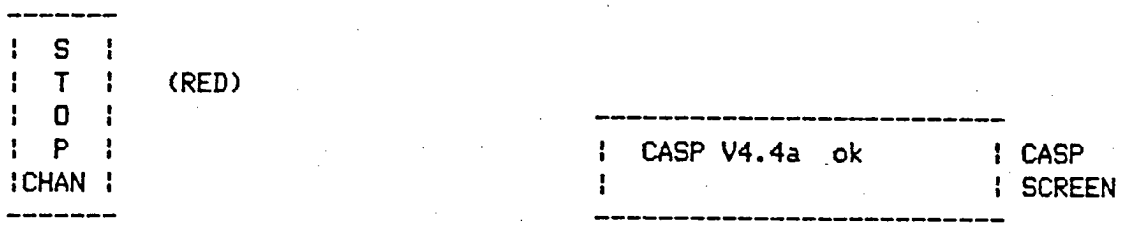
This procedure will recondition (rejuvenate) a good percentage of nickel-cadmium batteries. Especially if reFLEX charging has been preprogrammed into your CASP, RECONDITION cycles will be more effective in reviving them. Once RECONDITIONED, some ni-cads with "memory" problems will be renewed, or even better than new. Some will not respond. CASP reconditioning with reFLEX is so effective that batteries, which otherwise might have to be scrapped, can be put back into use. The savings in battery replacements costs can be significant.

This method first discharges the battery to the level defined as fully discharged (See Para. F-5), then charges it with the "standard" charge method programmed for that particular cable and battery when the BLUE "CHARGE" KEY has been pressed. It repeats this cycle three times in succession which is equivalent to three ANALYZE 1 cycles (See Para. F-6.2), one after another. This cycle is obtained by first pressing the GREEN "DN" SHIFT KEY and then the BLUE "ANALYZE/RECOND" KEY.

At the conclusion of reconditioning, the CASP LCD screen displays information similar to that following ANALYZE 2, providing the operator with an analysis of the discharge (D) capacity of the battery in amp-hours (AH) and the time the discharge took. This information allows you to decide whether reconditioning was successful or not.

SECTION G
KEYBOARD REFERENCE SECTION

G-1. THE RED "STOP CHAN" KEY



Whether you need to make an emergency processing halt or are simply stopping the process on one channel or stopping one process to begin another, there are two ways to do it.

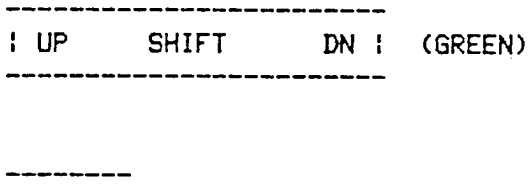
To stop BLUE TASK KEY processing on one channel, press the RED "STOP CHAN" KEY. This terminates processing on that one channel only, and CASP will attempt to use the same process on the next higher numbered channel. The RED "STOP CHAN" KEY is used to access any channel for the purpose of BLUE TASK KEY functioning.

To stop any BLUE TASK KEY processing on all channels, press the "UP" side of the GREEN SHIFT KEY (see Para. G-2, below) and then the RED "STOP CHAN" KEY. Pressing the "UP" SHIFT KEY and the RED "STOP CHAN" KEY a second time places your CASP unit into the idle or "ok" mode.

Whenever you want to start new processing, your CASP must be in the "ok" mode.

The CASP screen indicating the "ok" mode is shown above.

G-2. GREEN SHIFT KEY and GREEN ALPHA-NUMERIC KEYS



The GREEN "UP" or "DN" end of the SHIFT KEY used before another key (BLUE, YELLOW, RED or GREEN ALPHA-NUMERIC), enables the second key to perform three separate tasks. The selected key performs one function when it is used alone; another when used with the "UP" SHIFT KEY; and a third used with the "DOWN" SHIFT KEY.

To shift "UP" or "DN", first press the appropriate end of the SHIFT KEY. You should hear a "beep". Then press the key which performs the "SHIFT" function you desire. You should hear a second "beep" tone.

The GREEN ALPHA-NUMERIC KEYS are used to give commands such as the one turning CASP into a power supply. (Ref. C-3.1.4)

The GREEN ALPHA-NUMERIC KEYS are used alone or following pressing the GREEN SHIFT KEY to enter both numbers and letters.

Example:

"3" KEY: Enters the numeral "3"

"UP" followed by "3" KEY: Enters the letter "I"

"DN" followed by "3" KEY: Enters the letter "V"

G-2.1. OPERATOR'S USE OF GREEN ALPHA-NUMERIC KEYS

"C" Initiate an internal calibration cycle.

"D" Enter download function.
For loading the CASP memory from an external computer. This mode is exited upon completion of a download, or when power is turned off.

"I" "UP" end of SHIFT followed by "3" KEY:

An operator will use the letter "I" when he wishes to inspect the user programmable tables. He will check to see that they are appropriate for his battery processing or power supply requirements (See Section H, CASP COMPUTER TABLE INSPECTION).

"L" "UP" end of SHIFT followed by "-" KEY:

The letter "L" locks the CASP LCD screen display, so that it will not go off after the pre-programmed number of seconds. This display lock only works while the unit is charging or discharging.

To cancel the display lock command and unlock it, enter the "L" a second time.

"P" "DN" end of SHIFT followed by "9" KEY:

CASP usually comes factory pre-programmed (not user re-programmable) with "automatic" printing. This "automatic" setting operates when a compatible printer is connected and turned on. It will print out after each charge and each discharge.

In addition, when CASP is in the "READY" mode, entering the letter "P" will cause information brought on to the CASP LCD screen to be printed.

Compatible printers are the CHRISTIE Optional Snap-In Printer Model CP-40; External Serial Printer Okidata ML92S; or an equivalent printer with 1200 Baud, no parity, 8 data bits, and 1 stop bit. The printer is connected to the RS232 output at the back of the power supply module.

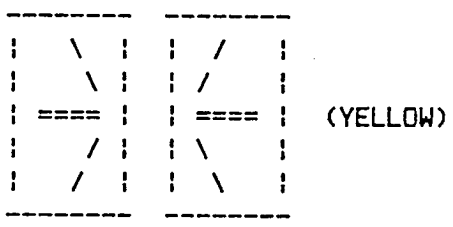
"R" "DN" end of SHIFT followed by "5" KEY:

An operator will use the letter "R" when he wishes to recalibrate CASP (See Section GG, in the CASP Programmer's Manual).
If you accidentally enter this mode, IMMEDIATELY press "STOP".

"V" "DN" end of SHIFT followed by "3" KEY:

An operator will use the letter "V" when he wishes to place CASP into the mode in which it functions as a voltage and current programmable power supply (350 watt). (See Section J, DC POWER SUPPLY OPERATION).

G- 3. YELLOW ARROW KEYS



The YELLOW ARROW KEYS are used to step through the data display after pressing one of the YELLOW INFORMATION KEYS for each channel. Press the RIGHT --> ARROW KEY to step through the channels from 1 through 6, and back to channel 1. The LEFT <-- ARROW KEY steps in the opposite order.

G-4. YELLOW INFORMATION KEYS

G-4.1. "VOLTS" KEY

G-4.1.1. "VOLTS" KEY--WHEN NOT PROCESSING

VOLTS	(YELLOW)	Chan 1: 15.21 Volts	CASP SCREEN

Channels are selected by using the YELLOW --> RIGHT ARROW KEY to step through from one to the next. In this example the CASP screen shows that Channel 1 was selected.

When a battery is connected, pressing the "VOLTS" KEY turns the LCD screen into a digital voltmeter which gives you the open circuit voltage of the battery connected to that channel.

G-4.1.2. "VOLTS" KEY--WHEN PROCESSING A BATTERY

VOLTS	(YELLOW)	Chan 2: 14.46 Volts Chan 2 00:01:42 D	CASP SCREEN

In this example the CASP screen is looking at Channel 2.

When a battery is connected and being processed, pressing the "VOLTS" KEY tells you the voltage of the battery connected to that channel (the first line of the CASP screen).

The second line is ticking off the processing time and indicates the type of processing. In this case "D" means that the battery is discharging. The digits separated by colons will be increasing, indicating the amount of processing time in hours, minutes and seconds.

When a battery is being reFLEX charged, the CASP digital voltmeter displays the voltage at the completion of each negative pulse (trough voltage). Discharge pulses during reFLEX charging (as large as 35 amps with a ni-cad, D-cell, for example) allow CASP's digital voltmeter to become a continuous battery tester. Ordinarily, voltmeters read voltage only when charge (not discharge) current is flowing, which is frequently misleading.

G-4.2. "AMPS" KEY

G-4.2.1. "AMPS" KEY--WHEN NOT PROCESSING

AMPS	(YELLOW)	Chan 4: 00.00 Amps	CASP SCREEN

Channels are selected by using the YELLOW --> RIGHT ARROW KEY to step through from one to the next. In this example the CASP screen shows that Channel 4 was selected.

When a battery is connected, pressing the "AMPS" KEY turns the LCD screen into a digital ammeter indicating charge and discharge current values. In this example the "AMPS" KEY tells you that there is no current flowing through the battery connected to Channel 4.

G-4.2.2. "AMPS" KEY--WHEN "CHARGE" KEY CHARGING

AMPS	(YELLOW)	Chan 2: 14.0 Amps Chan 2 00:01:12 C	CASP SCREEN

Pressing the "AMPS" KEY tells you the current with which CASP is charging the battery connected to Channel 2 (the first line of the CASP screen).

The second line is ticking off the processing time and indicates the type of processing. In this case capital "C" means that the battery is "CHARGE" KEY charging. The digits separated by colons will be increasing, indicating the amount of processing time in hours, minutes and seconds. NOTE: capital "C" = CHARGE; lower case "c" = ALT CHARGE.

G-4.2.3. "AMPS" KEY--WHEN SIMULTANEOUSLY CHARGING SEVERAL BATTERIES

AMPS	(YELLOW)	Chan 5: 02.10 Amps Chan 5 04:11:35 c*	CASP SCREEN

During essentially simultaneous charging of up to six batteries at a time (see Para. F-4.2., "UP" SHIFT plus ALT CHARGE), the amperes displayed by pressing the YELLOW "AMPS" KEY is six times the ALTERNATE CHARGE amps entered into the INDIVIDUAL BATTERY PARAMETER TABLE, see Para. H-3.6.

The second line is ticking off the processing time and indicates the type of processing. Here, lower case "c*" means that the battery is simultaneous "alt" charging. NOTE: capital "C" = CHARGE; lower case "c" = ALT CHARGE.

G-4.2.4. "AMPS" KEY--WHEN DISCHARGING THE BATTERY

AMPS	(YELLOW)	Chan 3: -03:50 Amps Chan 3 00:05:44 D	CASP SCREEN

When a battery is connected and being discharged, pressing the "AMPS" KEY tells you the current with which CASP is discharging the battery connected to that channel (the first line of the CASP screen). The minus ("-") sign before the number of "Amps" confirms that this is a discharge (not charge) current value.

The second line is ticking off the processing time and indicates the type of processing. In this case "D" also shows that the battery is discharging.

G-4.3 "TYPE" KEY

G-4.3.1 TO VERIFY ATTACHED CABLE NUMBER "UP" SHIFT plus "TYPE" KEY

```
-------------------------
| UP     SHIFT      DN |  (GREEN)
-------------------------

------------
|   TYPE   |  (YELLOW)
------------

                                  -------------------------
                                  | Chan 2:  Cable #118   | CASP
                                  | 4.00AH 12CELL 14.40V  |SCREEN
                                  -------------------------
```

The GREEN "UP" SHIFT KEY is used before the YELLOW "TYPE" KEY to verify the number of the actual cable to the battery connected. The numbers on the CASP-end of the cable MUST match the number on the screen, for the selected channel.

G-4.3.2 BATTERY NAME: WHEN NO BATTERY CABLE IS CONNECTED "TYPE" KEY USED ALONE

```
------------
|   TYPE   |  (YELLOW)
------------

                                  -------------------------
                                  | Chan 1: Unknown type  | CASP
                                  |                       |SCREEN
                                  -------------------------
```

Channels are selected by using the YELLOW --> ARROW KEY to step through from one to the next. In this example the CASP screen shows that Channel 1 was selected.

When no battery cable is connected, pressing the "TYPE" KEY will also display this message.

G-4.3.3 BATTERY NAME: WHEN PROCESSING A BATTERY "TYPE" KEY USED ALONE

```
------------
|   TYPE   |  (YELLOW)
------------

                                  -------------------------
                                  | Chan 2:Christie KR-1  | CASP
                                  | 4.00AH 11 Cell 13.20V |SCREEN
                                  -------------------------
```

If you have the correct cable for the battery being processed, pressing the "TYPE" KEY verifies that you and the computer agree about the actual battery type connected.

In the example CASP screen, the first line gives the channel number and the name of the battery cable connected to it.

The second line gives the nominal ampere-hour (AH) rating for the battery, the number of cells it has, and its nominal voltage rating.

G-4.4 "HISTORY" KEY

G-4.4.1 "HISTORY" KEY--WHEN PROCESSING WAS SUCCESSFUL

```
------------                    -------------------------
| HISTORY  |  (YELLOW)          |  Ref Charge       Ok   | CASP
------------                    |  Chan 5 00:05:34 C     |SCREEN
                                -------------------------
```

The "HISTORY" KEY tells you the battery's processing time, and whether that processing has gone well, if it is completed.

The "Ok" code will appear alone.

The example CASP screen shows that the battery connected to Channel 5 was reFLEX charged, and that it took 5 minutes and 34 seconds to complete the CHARGE (C).

If a "^", "v", "+", or "-" appear after the "C", they indicate the charge cutoff condition:

G-4.4.2 "HISTORY" KEY--WHEN PROCESSING WAS NOT SUCCESSFUL

When processing was not properly completed, pressing the "HISTORY" KEY will show a STAR (*) in the upper right hand corner of the CASP screen, accompanied by a code indicating what the problem was.

```
------------                    -------------------------
| HISTORY  |  (YELLOW)          |  Ref Charge       Op* | CASP
------------                    |  Chan 3 00:00:00 C     |SCREEN
                                -------------------------
```

The letters "Op" on the example CASP screen indicate that the attached battery failed the "rail" test of its impedance (or equivalent resistance), either just before or during processing, or that there is an open circuit. It also shows that reFLEX charging was attempted on the battery connected to Channel 3, but that the problem would not allow the battery to be charged (C) at all, so no time is displayed. Thus, it was an open circuit or the initial "rail" test which causes the error message "Op*".

```
------------                    -------------------------
| HISTORY  |  (YELLOW)          |  Discharge        St* | CASP
------------                    |  Chan 1 00:02:54 D    |SCREEN
                                -------------------------
```

"St" stands for stop and indicates that someone interrupted processing before it was complete. It also shows that the battery connected to Channel 1 was discharged (D) for 2 minutes and 54 seconds before processing was stopped.

```
------------                    -------------------------
| HISTORY  |  (YELLOW)          |  Discharge        Sh* | CASP
------------                    |  Chan 3 00:00:00 D    |SCREEN
                                -------------------------
```

The code "Sh" indicates a short in the output -- presumably in either the battery or the cable. It also shows that the battery connected to Channel 3 was not discharged (D) at all, as no time is displayed.

```
------------                    -------------------------
| HISTORY  |  (YELLOW)          |  Alt Charge       Rp* | CASP
------------                    |  Chan 3 00:00:00      | SCREEN
                                -------------------------
```

"Rp" stands for reversed polarity. The battery was driven negative or connected backwards to the cable. The CASP example screen shows that the battery connected to Channel 3 was not discharged (D) at all, as no time is displayed.

```
------------                    -------------------------
| HISTORY  |  (YELLOW)          |  Ref Charge       Ot* | CASP
------------                    |  Chan 6 00:00:01 C    | SCREEN
                                -------------------------
```

If the code "Ot" appears when processing a battery with a compatible, properly working, third wire, temperature sensing capability, it stands for battery over temperature. This sensing capability is used as a backup to CASP's computer sensing.

ALTERNATELY, "Ot" CAN INDICATE THAT THE BLUE THIRD (TEMPERATURE SENSING) WIRE HAS AN OPEN CIRCUIT: MAKE SURE THAT THE BLUE WIRE IS CONNECTED TO THE RED WIRE IF THE BATTERY DOES NOT HAVE A COMPATIBLE THIRD TERMINAL.

This example shows that the battery connected to CASP's Channel 6 received only one second of reFLEX charging (C).

HISTORY	(YELLOW)	Ref Charge Ti*	CASP
		Chan 5 00:22:00	SCREEN

The code "Ti" stands for over time. The reFLEX charging of the battery connected to Channel 5 exceeded the maximum time programmed for it, as a backup shutoff. The CASP did not reach computer cutoff in the maximum time allowed for it. This may indicate that there is something wrong. A new battery or one out-of-service for some time can cause this code to appear. If you believe that there is nothing wrong and if the battery is cool, disconnect it, then reconnect it to re-start charging.

WARNING: IF YOU RE-START CHARGING, YOU MUST MONITOR THE BATTERY FOR ANY ABNORMAL SIGNS DURING THIS ENTIRE SECOND ATTEMPT AT CHARGING. IF THE COMPUTER DOES NOT TERMINATE THE CHARGE WITHIN 20% OF THE TIME IT FIRST SHUT OFF (4.4 MINUTES, IN THIS EXAMPLE), DISCONNECT THE BATTERY AND INVESTIGATE THE PROBLEM.

Note: If you get the "Ti*" code and the elapsed time shown is less than the programmed maximum time, the battery may have had an "Ot*" condition.

G-5. BLUE TASK KEYS

G-5.1. "CHARGE" KEY

Pressing the BLUE "CHARGE" KEY automatically initiates a variety of possible methods of standard charging and charge termination processes. See Paragraph F-2.1. in the PROCESS REFERENCE SECTION. The pre-programmed charge procedure for any type of rechargeable battery (sealed cylindrical nickel-cadmium packs, aircraft sintered vented ni-cads, sealed or vented lead acid, silver zinc, or any other) is automatically initiated, depending on what processes are called for by the "ID" of the connecting cable on each channel. Each battery on the different channels can be a different type.

If during charging, a "+" appears on the screen, this indicates that the battery is already in a charged state. Further processing is not necessary.

If a "-" appears, it indicates that ni-cads being charged are new or have been on the shelf for a long period of time. The standard charge will not be sufficient processing. It will be necessary to give the battery one cycle of "ALT CHARGE" or one "RECOND" cycle to obtain satisfactory results.

CHARGE	(BLUE)

- Ref Charging-	CASP
Chan 1 00:02:25 C	SCREEN

The example CASP screen shows the "CHARGE" KEY has initiated reFLEX charging, as called for by the programming matching the battery cable attached to Channel 1.

The battery on Channel 1 has been charging (C) for 2 minutes and 25 seconds. The "^" indicates that the standard cutoff (Category A) is employed, rather than the maximum (Category B), which would be indicated by a "v", on the lower line. Category B serves as a backup to A.

```
------------                    --------------------------
| CHARGE   |  (BLUE)            |     -CC  Charging-     | CASP
------------                    |  Chan 2 00:00:31 C     | SCREEN
                                --------------------------
```

Pressing the "CHARGE" KEY begins constant current (CC) charging if the connecting battery cable calls for it, as in this example. The battery on Channel 2 has been charging for 31 seconds.

```
------------                    --------------------------
| CHARGE   |  (BLUE)            |     -CP Charging-      | CASP
------------                    |  Chan 3 00:02:54 C     | SCREEN
                                --------------------------
```

Here, pressing the "CHARGE" KEY has started constant potential (CP) charging, as the attached battery cable required. The battery on Channel 3 has been charging for 2 minutes and 54 seconds.

```
------------                    --------------------------
| CHARGE   |  (BLUE)            |     -TCO Charging-     | CASP
------------                    |  Chan 4 00:00:12 C     | SCREEN
                                --------------------------
```

Here, pressing the "CHARGE" KEY has started constant current charging with temperature sensing cutoff (TCO). TCO, as a primary cutoff, rather than as a backup, is usually used only if the charger does not have a sophisticated computer cutoff capability. TCO is not recommended as a primary cutoff method because the battery is forced to get hotter during charge. The battery on channel 4 has been charging for 12 seconds.

G-5.2 "DISCHARGE" KEY

DISCH	(BLUE)

-Discharging-	CASP
Chan 5 01:01:14 D	SCREEN

Pressing the "DISCH" KEY causes the connected battery to be discharged to an average voltage level as defined in Paragraph F-5. The battery on Channel 5 has been discharging for 1 hour, 1 minute, and 14 seconds.

G-5.3. "ANALYZE/RECOND" KEY

This key can help you determine the condition of a battery. It can also recondition a tired battery, often making it as good as new.

Para. F-6 in the BATTERY PROCESSING REFERENCE SECTION, contains detailed explanations of the three processes initiated by the "ANALYZE/RECOND" KEY. The type of ANALYZE/RECONDITION cycle is selected by using the key alone or in conjunction with the GREEN "UP" or "DN" SHIFT KEY.

G-5.3.1. TESTING DISCHARGE CAPACITY "UP" SHIFT plus "ANALYZE/RECOND" KEY "^ANALYZE"

UP SHIFT DN	(GREEN)

ANALYZE RECOND	(BLUE)

-^Ref Analyze-	CASP
Chan 1 00:01:06 D	SCREEN

This cycle brings the battery to full charge by whatever standard charging method is programmed to be used when the BLUE "CHARGE" KEY is pressed, then discharges it to the level defined as fully discharged in Para. F-5, analyzing its discharge capacity. Then it charges the battery again so it's ready for use. At the conclusion it displays the discharge (D) amp hours (AH) and the time the discharge took. Further definition of this process may be found in Para. F-6.1., BATTERY PROCESSING REFERENCE SECTION.

G-5.3.2. TESTING CHARGE CAPACITY
"ANALYZE/RECOND" KEY USED ALONE
"ANALYZE"

ANALYZE / RECOND	(BLUE)	-ref Analyzing - Chan 1 00:02:42 C	CASP SCREEN

The processing of this key can be considered either as a charging method, or as a means of analyzing a battery's charge capacity. The battery is first constant current discharged to the level defined as fully discharged in the SHARED PARAMETER TABLES 090-093, Para. H-3.4. Then it is recharged applying whatever standard charging method programmed for the particular battery when the BLUE "CHARGE" KEY has been pressed (reFLEX charging in this case). The charge needed to recharge the battery is measured, and displayed, as below.

At the conclusion of the cycles, the screen displays the charge (C) amp hours (AH) and the time, as shown above.

Detailed information about both uses of the ANALYZE 1 is contained in the Para. F-6, BATTERY PROCESSING REFERENCE SECTION.

G-5.3.3. RECONDITIONING NI-CADS
"DN" SHIFT plus "ANALYZE/RECOND" KEY
"v ANALYZE"

UP SHIFT DN	(GREEN)

ANALYZE / RECOND	(BLUE)	-vRef Analyze 00.44AH Chan 6 00:03:17 D	CASP SCREEN

This cycle first discharges the battery to the level defined as fully discharged in the SHARED PARAMETER TABLES 090-093, Para. H-3.4, then charges it with the standard charge method programmed for that battery. It repeats this cycle three times in succession to recondition it.

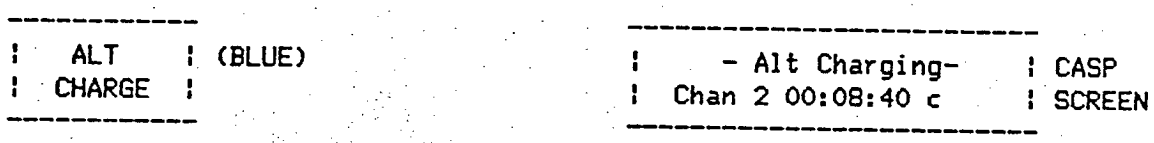
This procedure reconditions ni-cad batteries with faded capacity (memory), particularly if reFLEX charging is employed. At the conclusion of reconditioning, CASP displays the discharge (D) amp-hours (AH) and the time the discharge took.

G-5.4. "ALT CHARGE" KEY

The two charge modes initiated by the "ALT CHARGE" KEY are slow charge methods. With ni-cads, these methods would be used when you have a new pack, a pack that has been in storage for many months, or a pack which you suspect has badly unbalanced cells. It is also used for high impedance or consumer grade packs.

See Paragraph F-4 in the BATTERY PROCESSING REFERENCE SECTION for more detail.

G-5.4.1. SEQUENTIAL SLOW CHARGING WITH TIMED CUTOFF "ALT CHARGE" KEY USED ALONE



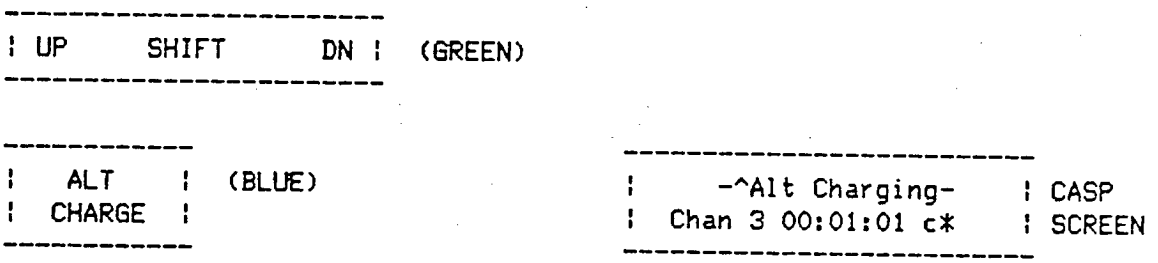
In this constant current charge mode, the six connected batteries are serviced one at a time. Each battery can be of a different type, but they must be constant current chargeable.

The second line shows the processing time for Channel 2 and indicates the type of processing. Here, "c" (lower case, no star) means the batteries are "alt" charging, one at a time, in sequence.

Total processing time for all channels is the sum of the various charge times on each channel (which do not have to be the same).

THIS PROCESS MUST NOT BE USED TO CHARGE SILVER ZINC BATTERIES. Program the low rate current for 0.00 amps as a precaution.

G-5.4.2. SIMULTANEOUS SLOW CHARGING WITH TIMED CUTOFF "UP" SHIFT plus "ALT CHARGE" KEY



This mode initiates the essentially simultaneous charging of up to six batteries at a time. The batteries may be of different types, number of cells, capacity, etc. However, they must be batteries which can be constant current charged at the same relative rate and same total hours--typically, one tenth ampere hour capacity (C/10) in 16 hours. Total charge time for all six batteries will be the same as for one.

The charging current, when you use the YELLOW "AMPS" KEY to check it, will be six times the average ALT CHARGE value. On each channel in turn, this high amperage is on for 10 seconds, then off for 50 seconds.

The second line is ticking off the processing time and indicates the type of processing. In this case "c*" (lower case, with a star) means that the battery is simultaneous "alt" charging.

CAUTION: THIS PROCESS MUST NOT BE USED TO CHARGE SILVER-ZINC BATTERIES.

SECTION H
CASP COMPUTER PROGRAMMING TABLE INSPECTION SECTION

The CASP operator will need to read the pre-programmed parameters being utilized to process batteries in order to check that they are correct. Initially, they must be verified in two locations:

-- The print-out of your CASP's custom programmed parameters (located in the back pocket of the CASP manual) must be verified. They should meet your facility's requirements.

-- The CASP computer user tables should be inspected for appropriateness of the parameters.

However, you will not be able to make changes in the tables. Only your facility's authorized CASP programmer can make changes in the computer user table parameters according to the CASP Programmer's Manual. A PROGRAMMER PASSWORD code enables the programmer to change the parameters.

The next section will summarize the CASP computer user tables, and the following two sections will enable you to understand and inspect your CASP's custom programmed parameters in both locations.

H-1. CASP USER PROGRAMMABLE TABLES--A SUMMARY

The CASP user programmable tables are divided into three groups.

H-1.1. BATTERY CABLE TABLES

TABLES 100 TO 131 correspond to thirty-two battery cables, each with a different computer ID. Each of these tables ties a particular INDIVIDUAL BATTERY PARAMETER TABLE to a specific BATTERY CABLE TABLE.

H-1.2. INDIVIDUAL BATTERY PARAMETER TABLES

TABLES 000 TO 019 are twenty INDIVIDUAL BATTERY PARAMETER TABLES, each dedicated to a battery by a set of eight specific values or parameters. The parameters define the program or cycle with which CASP will process the battery.

H-1.3. CELL TABLES

TABLES 090 TO 093 set values which are SHARED by all batteries of a particular type, e.g., lead-acid, nickel-cadmium, silver-zinc.

TABLE 099 sets values for the regulated voltage and current when CASP is used as a power supply. It also sets values which are SHARED by all CASP battery operations, such as the length of time certain data are displayed on the screen.

H-2. UNDERSTANDING YOUR CUSTOM COMPUTER PRINT-OUT

H-2.1. BATTERY CABLE TABLES--100 TO 131

```
CABLE #, BATTERY NAME, (PARAMETER TABLE #)
100  USER ASSIGN     (019)
101  USER ASSIGN     (019)
102  USER ASSIGN     (019)
103  USER ASSIGN     (019)
104  USER ASSIGN     (019)
105  USER ASSIGN     (019)
106  CHRISTIE ER8    (000)
107  CHRISTIE ER6    (001)
      etc. (108 - 131)
```

FIGURE 6. Example of BATTERY CABLE TABLE Print-Out

The first tables in your print-out are formatted as in FIGURE 6 and the function is described in Paragraph H-3.3.

Number 019 is entered where there is no pre-programmed battery already entered into the table. "019" must be replaced when your CASP programmer wants to program CASP for a new battery type.

The "battery name" shows "USER ASSIGN" where there is no pre-programmed battery already entered into the table. When there is a pre-programmed battery, the name has been entered, as in #106 and 107 in FIGURE 6.

If the battery name is to be deleted, rename with an obvious message (such as "USER ASSIGN").

H-2.2. INDIVIDUAL BATTERY PARAMETER TABLES--000 TO 019

PARAMETER TABLE 000

1- CHARGE CURRENT	9.00
2- DISCH. CURRENT	1.13
3- LOW RT CURRENT	0.23
4- AMP HOURS	2.25
5- # OF CELLS	10
6- CHARGE CODE	A91M
7- CHARGE TIME	23
8- LOW RATE TIME	1600

FIGURE 7 Example of INDIVIDUAL BATTERY PARAMETER TABLE print out

The next group of tables prints out as in FIGURE 7. Compare these with FIGURE 13, showing the same computer table as it is displayed for inspection on CASP's LCD screen.

The example shows table 000. Your print-out contains such a table for each INDIVIDUAL BATTERY PARAMETER TABLE, numbers 000 through 019.

The function of these tables is described in Para. H-3.6.

H-2.3. CELL TABLES--090 TO 093

CELL TABLES

TBL#	1>RAIL	2>DISC	3>NOM	4>CC	5>CP
90	2.50	1.20	1.50	2.00	2.17
91	2.50	1.00	1.20	0.50	1.55
92	3.00	1.80	2.00	0.50	2.40
93	0.50	0.50	0.50	0.50	0.50

FIGURE 8 Example of CELL TABLES 090 to 093 Print-Out

The next group of tables prints out as in FIGURE 8. Compare these with FIGURE 11, showing the same computer table as it is displayed on CASP's LCD screen.

The function of these tables is described in Para. H-3.4.

H-2.4. SHARED PARAMETER TABLE--099

```
MISC DATA
1-PROTECT TIME          150       *
2-PRINTER FLAG          192
3-BIG SLOPE             5
4-MIN DIFFERENCE     !  32
5-NUM OF PASS           0
6-PAUSE TIME            001       *
7-LOW SLOPE             32
8-WATCHDOG FLAG         0
9-CHECKSUM FLAG         0
10-TCO POLARITY         0
11-^ALT CHG T/CHAN      10
12-^ALT CHG T/SET       60
13-^ALT CHG C MULT      6
14-P/S VOLTS            13.5      *
15-P/S AMPS             10.0      *
16-^ALT CHG TIME        1400      *
17-USER ACCESS          USMART
18-VERSION              CASP V4.4a ok
```

FIGURE 9 Example of SHARED PARAMETER TABLE 099 Print-Out

The table prints out as in FIGURE 9. Compare these with FIGURE 12, showing the same computer table as it is displayed on CASP's LCD screen.

The heading "Misc Data" is used in place of SHARED PARAMETER TABLE 099. The table number doesn't print out at all.

"Misc Data" contains many factory settings which are not available for examination or reprogramming by the user. The items marked with a star (*), are the only ones which may be inspected or altered from the CASP keyboard. They are items 1, 6, 14, 15 and 16. The "^" shown in item 16 indicates the "UP" SHIFTED, "ALT CHARGE" time value.

The function of this table is described in Paragraph H-3.5.

H-3. INSPECTING THE COMPUTER USER TABLE PARAMETERS

H-3.1. ENTERING THE TABLE NUMBER OF YOUR CHOICE

Upon pressing the Inspection letter,"I" ("UP" SHIFT and then the "3" KEY). CASP will display the screen below. Type in the number of the computer user table you wish to access, using the GREEN ALPHANUMERIC KEYS.

```
-------------------------
| Enter Table #         | CASP
|    003                | SCREEN
-------------------------
```

H-3.2. STEPPING THROUGH, AND LEAVING THE COMPUTER TABLES

H-3.2.1. MOVING FROM ONE SCREEN IN A TABLE TO THE NEXT

Once the computer table number you wish to access has been selected, the YELLOW RIGHT ARROW KEY is used to move left-to-right from one screen of the computer table to the next.

The YELLOW LEFT ARROW KEY may be used to back up letter-by-letter, right-to-left. At the break on the left edge, between screens, pressing the LEFT ARROW KEY will access the previous screen.

When you have completed checking a particular table, repeated use of the YELLOW RIGHT ARROW KEY will bring you back to the beginning Table Number Screen shown above.

H-3.2.2. MOVING FROM ONE TABLE TO ANOTHER, OR LEAVING TABLES

Once you have returned to the Table Number Screen, you can access a different table number for examination by entering a new table number.

To leave a table in the middle, without returning to the initial screen, press the RED "STOP CHAN" KEY. You will have exited the computer tables. Then you can re-enter them by entering the letter "I" again.
DO NOT turn the unit off while in the inspection mode. Press "STOP" first.

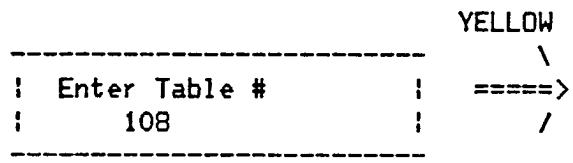
H-3.3 INSPECTING THE BATTERY CABLE TABLES---100 TO 131

	CABLE TABLE NO.	BATTERY NAME	INDIVIDUAL PARAMETER TABLE NO.
	100	USER ASSIGN	019
===>	108	CHRISTIE HR1	002

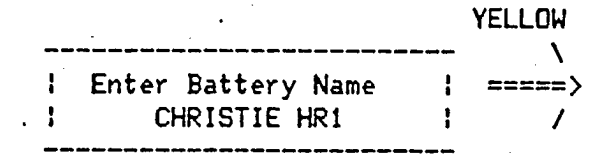
FIGURE 10 Example of BATTERY CABLE TABLES

FIGURE 10. shows an example of two BATTERY CABLE TABLES. The first one, #100, is "empty". Your CASP programmer could enter a battery to be processed by typing over the "CABLE 100" with the battery name, and over the "019" with the correct INDIVIDUAL BATTERY PARAMETER TABLE number.

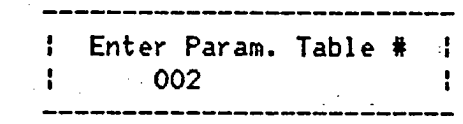
Number 108 (marked with the arrow) is the example row, stepped across below, from left to right.



On the "Table #" screen, enter the cable number of the cable connected to Channel 1--e.g., "108". Press the RIGHT ARROW KEY.



Now check that the battery which connects to the "108" cable on Channel 1 is, in fact, a "Christie HR1", as shown on the screen. Press the RIGHT ARROW KEY.



The INDIVIDUAL BATTERY PARAMETER TABLE, #002, is tied to BATTERY CABLE TABLE, #108. Check that table number to be sure the parameters are appropriate for the connected battery.

WARNING: IMPROPER INDIVIDUAL BATTERY PARAMETER TABLE NUMBER ENTERED HERE MAY RESULT IN BATTERY FAILURE, POSSIBLY VIOLENT.

Repeat the above steps for each of the other cables you are using.

Use the YELLOW RIGHT ARROW KEY to return to the Table Number Screen.

H-3.4. INSPECTING THE SHARED PARAMETER TABLES--090 TO 093

These computer tables are called "SHARED" because they establish parameter sets for whole groups of batteries, such as settings common to all ni-cads or all silver-zinc batteries. Check with your CASP programmer if you have any doubts about the values you read on any of these tables.

	SHARED PARAMETER PARAMETER TABLE NO.	BATTERY TYPE	VOLTS PER CELL				
			"RAIL" MAX. VOLTS DURING CHARGE	DISCHARGE (CUTOFF) VOLTAGE	NOMINAL VOLTS PER CELL	CONSTANT CURRENT CHARGE CUTOFF VOLTAGE	CONSTANT POTENTIAL CHARGING VOLTAGE
print-out =)	CELL TABLES	========	1)RAIL	2) DISC	3) NOM	4) CC	5) CP
	090	Silver-Zinc	2.10	1.10	1.50	2.00	2.17 **
	091	Ni-Cads	2.50	1.00	1.20	0.50*	1.55
	092	Lead-Acid	3.00	1.80	2.00	0.50*	2.40
	093	****	0.50	0.50	0.50	0.50	0.50

FIGURE 11 The Entire SHARED PARAMETER TABLES 090 to 093

* Values in this table cannot be zero or blank. "0.50" has been entered instead.

** This value is actually an extension of table 092. It is the float voltage for lead-acid batteries, (charge code G) and is not used for silver-zinc batteries, even though it is in table 090.

**** This row has no battery group defined; battery groups to be entered as required.

FIGURE 11 shows the entire SHARED PARAMETER TABLES 090 to 093, indicating the example stepped through below (091) with an arrow, and the headings used in the custom pre-programmed print-out in the back pocket of your CASP Programmer's Manual (See Para. H-2.3.).

SHARED PARAMETER TABLE number 090 should be reserved for silver-zinc batteries. Ordinarily, upon receipt of your CASP, SHARED PARAMETER TABLE 093 will have "0.50" entered across it, in lieu of blanks.

```
                                    YELLOW1
  -------------------------          \
  |  Enter Table #        |  =====>
  |      091              |         /
  -------------------------
```

SHARED PARAMETER TABLE NUMBER 091, for processing nickel-cadmium batteries, is shown as an example.

Use the YELLOW RIGHT ARROW KEY to move to the next screen of the SHARED PARAMETER TABLE.

```
  !                                 YELLOW
  -------------------------          \
  |  Enter Rail V/Cell    |  =====>
  |      2.50             |         /
  -------------------------
```

The "rail" voltage value is the maximum expected voltage per cell subsequent to a current test pulse and during charging. It is this value against which each battery's impedance is checked during the "rail test". The entered value cannot exceed 3.05 volts per cell.

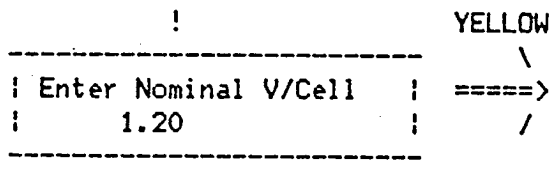
The "rail test" is a safety factor. Check with your CASP programmer if you have any doubts about the values you read on this screen, or if a particular battery continually fails the "rail test", as indicated by the star, "*" and the letters "Op" on pressing the YELLOW "HISTORY" KEY (unless that message is indicating an open circuit).

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

```
                                    YELLOW
  -------------------------          \
  |  Enter Disch V/Cell   |  =====>
  |      1.00             |         /
  -------------------------
```

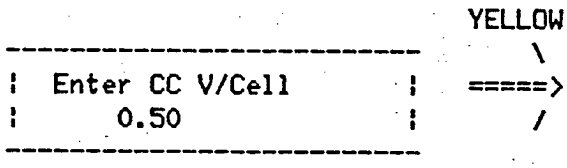
The discharge voltage value defines the cutoff voltage per cell during discharge. For ni-cads, this is usually one volt.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.



The number of nominal volts per cell for a nickel-cadmium battery is typically 1.2 or 1.25 volts per cell. This voltage is 2 volts for lead-acid and 1.5 volts for silver-zinc.

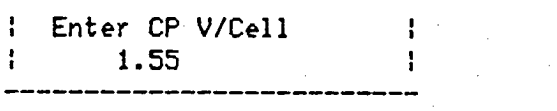
Press the YELLOW RIGHT ARROW KEY to move to the next screen.



The Constant Current charge cutoff value defines the voltage per cell at which charging will terminate in Constant Current (CC) charging. This is used primarily for silver-zinc batteries. This is typically 2.00 volts.

TABLE 091, which we are inspecting is for nickel-cadmium batteries. The entry cannot be zero, so "0.50" is entered.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.



The Constant Potential charge value defines the voltage per cell applied in Constant Potential (CP) charging.

Constant Potential charging is not appropriate for silver-zinc batteries, so the value entered in table 090 for constant potential charge voltage (usually "2.17") is an extension of table 092 (for lead-acid batteries), and is the "float" (or maintenance) voltage in Charge code "G", if ALT CHARGE is pressed, and has nothing to do with silver-zinc batteries.

Press the YELLOW RIGHT ARROW KEY to return to the Table Number Screen.

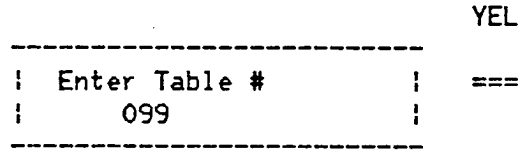
H-3.5. INSPECTING SHARED PARAMETER TABLE--099

Another SHARED PARAMETER TABLE, 099, sets parameters for other aspects of CASP use, such as those which regulate power supply operation and the time the LCD display remains on.

	SHARED PARAMETER TABLE NO.	POWER SUPPLY VOLTS	POWER SUPPLY AMPS	WAIT TIME (MIN.)	DISPLAY WAIT TIME (1/10 SEC.)	"UP" SHIFT (‡) ALT CHARGE TIME HRS.	"UP" SHIFT (‡) ALT CHARGE TIME MIN.	PRINTER CODE
printout \ ===> /	MISC. DATA	ITEM # 14	ITEM # 15	ITEM # 6	ITEM # 1	ITEM # 16		ITEM #2
	099	13.5	10.0	001	150	14	00	064

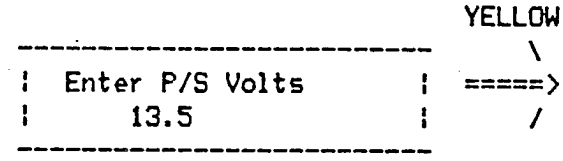
FIGURE 12 The Entire SHARED PARAMETER TABLE 099

FIGURE 12 shows the entire SHARED PARAMETER TABLE 099, indicating the headings used in the custom pre-programmed print-out in the back pocket of your CASP Programmer's Manual (See Para. H-2.4.).



Enter 099 into the Table Number Screen to access this SHARED PARAMETER TABLE NUMBER for inspection. Check with your CASP programmer if you have any doubts about the values you read on any of these tables.

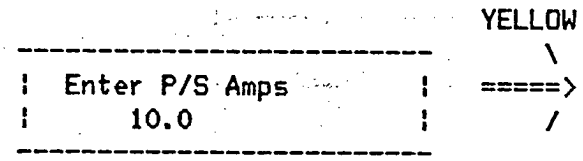
Use the YELLOW RIGHT ARROW KEY to move to the next screen of SIARED PARAMETER TABLE 099.



In this example, the power supply will operate at a regulated voltage of 13.5 volts.

WARNING: THE VALUES LISTED IN APPENDIX III MUST NOT BE DXCEEDED.

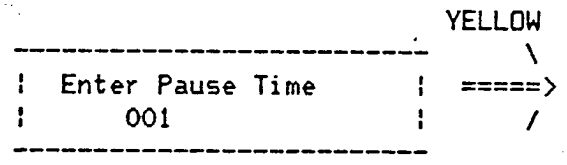
Use the YELLOW RIGHT ARROW KEY to move to the next screen of SHARED PARAMETER TABLE 099.



With the power supply amperage value here, the power supply will operate at the defined regulated voltage with 10 amperes current limiting.

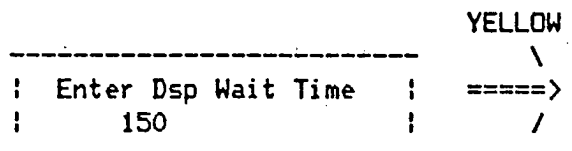
WARNING: THE VALUES LISTED IN APPENDIX III MUST NOT BE EXCEEDED.

Use the YELLOW RIGHT ARROW KEY to move to the next screen of SHARED PARAMETER TABLE 099.



In this example, CASP will pause for one minute between the discharge and the charge phases of the ANALYZING cycles available.

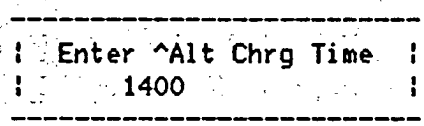
Use the YELLOW RIGHT ARROW KEY to move to the next screen of SHARED PARAMETER TABLE 099.



The Display Wait Time sets the length of time the CASP screen displays information such as voltage, current, type or history data, before it turns off. The example, 150, is in tenths of seconds, and indicates that the information will be displayed for 15 seconds.

Para. G-2.1 describes how to lock the display so that it remains on.

Use the YELLOW RIGHT ARROW KEY to move to the next screen



The "UP" shifted, "ALT CHARGE" time defines the length of time CASP's nearly simultaneous slow charging cycle will take. This cycle is described in Para. F-4.2., in the BATTERY PROCESSING REFERENCE SECTION. It is activated using the GREEN "UP" SHIFT KEY followed by the BLUE "ALT CHARGE" KEY.

The ^ indicates the "UP" SHIFTED process.

The first two digits entered are the HOURS and the second two digits entered are the MINUTES. In the example the cycle will take 14 hours and zero minutes.

CAUTION: "UP" SHIFT, "ALT CHARGE" TIME APPLIES TO ALL BATTERIES AT THE SAME TIME. THEREFORE, THE "ALT CHARGE" CURRENT MUST BE 1/10 AH ON ALL BATTERIES.

The printer code controls the type and frequency of printing. Available options are:

serial	000	Print only successful results with no "handshake"
RS232	064	Print all results with no "handshake"
modes	128	Print only successful results with "handshake"
	196	Print all results with "handshake"
CP-40	032	Print only successful results on the snap-in-printer
thermal	096	Print all results on snap-in-printer
printer		

Use the YELLOW RIGHT ARROW KEY to return to the Table Number Screen.

H-3.6. INSPECTING THE INDIVIDUAL BATTERY PARAMETER TABLES-- 000 TO 019

These tables apply to particular models or types of batteries, defining the battery's number of cells, ampere-hour rating, etc. However, one set of these parameters can apply to more than one battery model--ones that are similar electrically, but different mechanically. For example, CHRISTIE models KS12, KR2 and HR1 all have 12 ni-cad D-cells, and are processed according to the same individual battery parameter table, 002.

It is essential to verify the parameters being set by this group of tables, as they govern the way a connected battery is processed. The INDIVIDUAL BATTERY PARAMETER TABLE number is the identifying connection with the BATTERY CABLE TABLE you are using. It is entered in the last screen of the BATTERY CABLE TABLE.

	INDIVIDUAL BATTERY PARAMETER TABLE NO.	CHARGE AMPS	DISCHARGE AMPS	ALTERNATE CHARGE AMPS	AMP HOUR RATING	NO. OF CELLS	CHARGE CODE SEE EE-3.7	FAST/STNDRD CHARGE TIME (MIN)	ALT CHARGE TIME HRS : MIN
printout=> \ ====> /	PARAMETER TABLE NO.	CHARGE CURRENT	DISCHARGE CURRENT	LOW RATE CURRENT	AMP HOURS	# OF CELLS	CHARGE CODE	CHARGE TIME	LOW RATE TIME
	002	14.0	2.00	0.40	4.00	12	A : 91 : N	023	16 : 00

FIGURE 13 Example of INDIVIDUAL BATTERY PARAMETER TABLES

The example, marked with an arrow in FIGURE 13, is stepped through in the following text. The headings used in your custom CASP pre-programmed print-out are also indicated (See Para. H-2.2.).

```
                                YELLOW
-------------------------         \
|  Enter Table #        |   =====>
|      002              |        /
-------------------------
```

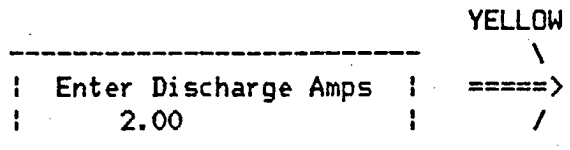
In the example, INDIVIDUAL BATTERY PARAMETER NUMBER 002 has been entered.

Use the YELLOW RIGHT ARROW KEY to move to the next screen of INDIVIDUAL BATTERY PARAMETER TABLE 002.

```
                                YELLOW
-------------------------         \
|  Enter Charge Amps    |   =====>
|      14.0             |        /
-------------------------
(10 amps max for CASP 1H)
```

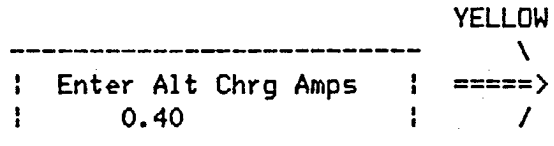
The Charge Amps value defines the amperage with which the connected battery will be charged.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.



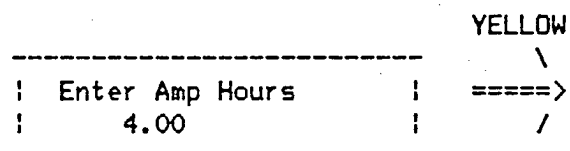
The Discharge Amps value defines the amperage with which CASP will discharge the connected battery whenever that process is called for.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.



When CASP is slow charging batteries with the Alternate Charge method, it will use this "Alt Charge Amps" average value to do so. On the next screen you find the ampere-hour rating of the battery being programmed. The Alt Charge Amps entered here must typically be 1/10 OF THE AMP-HOUR (AH) RATING.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.



Check that the Amp-Hour rating of the battery is entered correctly.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

```
                                        YELLOW
-------------------------                  \
|  Enter # of Cells     |  =====>
|      12               |       /
-------------------------
```

Check that the Number of Cells shown corresponds to the number of cells in series between the terminals. Double check by measuring the battery voltage, using the YELLOW "VOLTS" KEY. It should be approximately equal to the number of cells multiplied by the nominal voltage per cell. This voltage is 1.2 or 1.25 volts for ni-cads, 2 volts for lead-acid, and 1.5 volts for silver-zinc.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

```
                                      YELLOW
-------------------------                \
|  Enter Charge Code    |  =====>
|      A  91  M         |       /
-------------------------
```

The Charge Code is the key to appropriate battery charging with CASP. It sets both the preferred charging method (e.g., reFLEX, constant current, constant potential) and the primary Charge Cutoff Category A-L being applied (e.g., computer state-of-charge, timed, voltage, temperature). Verifying it is most vital. It has three parts:

PART 1. CHARGE AND CUTOFF METHOD CATEGORY

Paragraphs F-2 and F-3, in the BATTERY PROCESSING REFERENCE SECTION describe the "CHARGE" KEY charging modes and the "CHARGE" KEY cutoff options, combined in Categories A through L of FIGURE 5, and the batteries to which they can be applied. The letter entered here indicates the combination being applied by CASP.

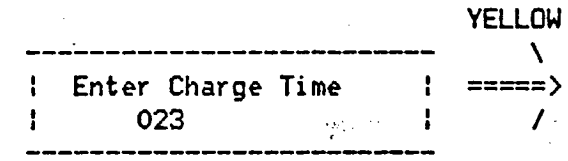
PART 2. SHARED PARAMETER TABLE

The SHARED PARAMETER TABLE, 090 through 093 (See Para.H-3.4.), being used is shown without the leading zero (i.e., 090 becomes 90).

PART 3. MINUTES OR HOURS

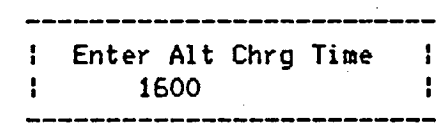
The next parameter to be entered deals with CHARGE TIME. The letter "M" or "H" entered here, for the third part of the CHARGE CODE, indicates whether the CHARGE TIME is in minutes (M) or hours (H).

Press the YELLOW RIGHT ARROW KEY to move to the next screen.



The Charge Time entered here indicates how long CASP will apply "CHARGE" KEY charging (or standard charging) to a connected battery, if the computer has not terminated charging earlier. The units are in minutes, if an "M" appears in the previous screen, and in hours, if an "H".

Press the YELLOW RIGHT ARROW KEY to move to the next screen.



The "ALT CHARGE" time entered here sets the amount of time CASP will process batteries in the sequential slow charging cycle. This cycle is described in Section F-2.3., in the BATTERY PROCESSING REFERENCE SECTION. It is accessed using the BLUE "ALT CHARGE" KEY alone.

The first two digits entered are the HOURS and the second two digits entered are the MINUTES. In the example the cycle will take 16 hours and zero minutes.

Use the YELLOW RIGHT ARROW KEY to return to the Table Number Screen.

SECTION I
STEP-BY-STEP CASP OPERATION

The following four sections will enable the CASP operator to follow down a check-list of steps to insure correct operation. The sections deal with the major CASP processes in turn: charging, discharging, analyzing and reconditioning batteries. This is intended to make your use of CASP as simple as possible.

Once CASP is properly programmed, programs have been proven to be safe, and your facility has a routine established (as suggested in Section B) daily operation can be as simple as plugging and unplugging batteries at the appropriate times.

Consider, for instance, a typical facility using CASP to charge batteries. Once CASP has been turned on and used to process batteries, it does not have to be turned off. It is not necessary to touch another key until you want to change the type of process (e.g., stop charging and start analyzing) or change the batteries being processed. If the same batteries are charged in the same manner, you simply plug and unplug the connecting cables as processing is completed. The same would be true for any other CASP process repeatedly used by your facility.

NOTES: (which apply to section I)

A. Once one of the BLUE KEYS have been pressed(step 4), it is not necessary to press it again, as long as you want to perform the same key function. Just unplug the old battery, and plug in the new battery at the battery end. (except with UP SHIFT ALT CHARGE)

B. Pressing "STOP" stops the process on the present channel and starts it on the next higher channel

C. Pressing UP-SHIFT then "STOP" a first time stops all processing. Pressing it again gets the unit ready for another blue or green key operation.

D. Press UP-SHIFT then TYPE keys to check if cable number is correct (also printed on cable).

E. Press TYPE key to check if battery type is correct.

F. Press VOLTS key to check voltage, AMPS key to check current.

G. When finished, turn rear switch to OFF.

CAUTION: A new battery, or one that has not been used for a while, MUST BE SLOW CHARGED (^ ALT CHARGE) at least once before using CHARGE or ANALYZE/RECOND.

I-1 CHARGING WITH CASP

STEP	ITEM/PURPOSE	PRESS KEYS(s)* OR TAKE ACTION INDICATED	REMARKS
1.	Power cord	Connect both ends	
2.	Output cables	Connect both ends	White dot up
3.	Rear ON/OFF switch	Turn unit on	Should beep twice.
4.	Charge battery	CHARGE key or ALT CHARGE key or ^ ALT CHARGE keys or ANALYZE/RECOND key	Fast or standard charge (F-2 & F-3) Sequential slow charge (F-4.1) "simultaneous" slow charge (F-4.2) Discharge before charge (F-6.3)
5.	Checking batteries during charge	Touch and observe	At least for first time - CHECK FOR EXCESSIVE HEATING GASSING OR SWELLING
6.	Listen for beeps	Battery is done	There will be a double beep when a battery cycle is completed
7.	Summary results	Read SUMMARY SCREEN	On top line: battery processing completed; on bottom line: battery processing not completed
8.	Individual results	HISTORY key, then RIGHT ARROW key successively	Gives charge time; gives failure mode, if not OK; read all channels

* if more than one key, first press one then the other.

STEP	ITEM/PURPOSE	PRESS KEYS(s)* OR TAKE ACTION INDICATED	REMARKS
1.	Power cord	Connect both ends	
2.	Output cables	Connect both ends	White dot up
3.	Rear ON/OFF switch	Turn unit on	Should beep twice.
4.	Discharge battery	DISCHARGE key	(F-5)
5.	Checking batteries during charge	Touch and observe	At least for first time - CHECK FOR EXCESSIVE HEATING GASSING OR SWELLING
6.	Listen for beeps	Battery is done	There will be a double beep when a battery cycle is completed
7.	Summary results	Read SUMMARY SCREEN	On top line: battery processing completed; on bottom line: battery processing not completed
8.	Individual results	HISTORY key, then RIGHT ARROW key successively	Gives discharge time; gives failure mode, if not OK; read all channels

* if more than one key, first press one then the other.

I-3 ANALYZING WITH CASP

STEP	ITEM/PURPOSE	PRESS KEYS(s)* OR TAKE ACTION INDICATED	REMARKS
1.	Power cord	Connect both ends	
2.	Output cables	Connect both ends	White dot up
3.	Rear ON/OFF switch	Turn unit on	Should beep twice.
4.	Analyze battery	^ ANALYZE/RECOND key or ANALYZE/RECOND key	Charge-discharge-charge (F-6.1) Discharge-charge (F-6.2)
5.	Checking batteries during charge	Touch and observe	At least for first time - CHECK FOR EXCESSIVE HEATING GASSING OR SWELLING
6.	Listen for beeps	Battery is done	There will be a double beep when a battery cycle is completed
7.	Summary results	Read SUMMARY SCREEN	On top line: battery processing completed; on bottom line: battery processing not completed
8.	Individual results	HISTORY key, then RIGHT ARROW key successively	Gives charge AH with ANALYZE/RECOND; gives discharge AH with ^ ANALYZE/RECOND; gives failure mode if not OK; read all channels

* if more than one key, first press one then the other.

STEP	ITEM/PURPOSE	PRESS KEYS(s)* OR TAKE ACTION INDICATED	REMARKS
1.	Power cord	Connect both ends	
2.	Output cables	Connect both ends	White dot up
3.	Rear ON/OFF switch	Turn unit on	Should beep twice.
4.	Recondition battery	v ANALYZE/RECOND key	Discharge-charge, 3 times (F-6.4)
5.	Checking batteries during charge	Touch and observe	At least for first time - CHECK FOR EXCESSIVE HEATING GASSING OR SWELLING
6.	Listen for beeps	Battery is done	There will be a double beep when a battery cycle is completed
7.	Summary results	Read SUMMARY SCREEN	On top line: battery processing completed; on bottom line: battery processing not completed
8.	Individual results	HISTORY key, then RIGHT ARROW key successively	Gives discharge AH; gives failure mode, if not OK; read all channels

* if more than one key, first press one then the other.

SECTION J
DC POWER SUPPLY OPERATION

Typing in the letter "V" will change the unit into a voltage and current programmable 350 watt power supply. This is achieved by first pressing the GREEN "DN" SHIFT KEY, and then the GREEN "3" KEY, which has the letter "V" in its lower right hand corner.

When CASP is functioning as a power supply, cables marked P/S or 098 are necessary. They can be connected to any channel. As many as six different pieces of equipment can be connected for operation.

WARNING: POWER SUPPLY CABLES MUST NEVER BE CONNECTED TO BATTERIES.

When functioning as a power supply, the six channels operate in parallel. The authorized programmer can set CASP to supply a regulated DC voltage, current, or both, with automatic crossover.

As a power supply, CASP can operate at 25 volts on all output cables. The maximum current is 14 amps, current limiting.

See appendix IV for maximum voltages and currents.

J-1. POWER SUPPLY UNDER NO-LOAD CONDITIONS

```
-------------------------
!   P/S   25.01 (25.0)V  ! CASP
!  MODE   00.02 (14.0)A  ! SCREEN
-------------------------
```

On each power supply screen, the top line indicates the voltage and the bottom line indicates the amperage. The values to the right in parentheses are the values programmed into CASP's SHARED PARAMETER TABLE (099) for power supply operation. They can be changed by following the programming procedure in para. BB-3 of the Programming Manual.

The values on the left are the operating values at the moment.

The screen above, shows no draw of current; the .02 amps shown are within meter accuracy. It shows programmed values of 25.0 volts and 14.0 amps. The potential on the screen shows a .01 variation from that setting, which is within meter accuracy.

J-2. POWER SUPPLY IN VOLTAGE REGULATION MODE

```
-------------------------
|   P/S   25.01 (25.0)V  | CASP
|  MODE   04.82 (14.0)A  | SCREEN
-------------------------
```

This is a constant potential power supply mode, the voltage is held constant, while the amperage varies.

The programmed values are the same as above, but the current being drawn is 4.82 amps. The unit will be in the voltage regulation mode as long as the current drawn is less than the programmed maximum value given in parenthesis.

J-3. POWER SUPPLY IN CURRENT REGULATION MODE

```
-------------------------
|   P/S   22.28 (25.0)V  | CASP
|  MODE   07.01 (7.00)A  | SCREEN
-------------------------
```

This is a constant current power supply mode, the amperage is held constant, while the voltage varies. The programmed current is 7.0 amps.

The operating potential in this current limiting mode example is 22.28 volts. The unit will be in the current regulation mode as long as the voltage shown is less than the programmed value given in parenthesis.

4. SUMMARY SCREEN FOR "UP" SHIFT, "ALT CHARGED" BATTERIES

```
-------------------------
| ^AltChrg 1 2 3 4 5 6  | CASP
| Look at               | SCREEN
-------------------------
```

This example shows that batteries attached to all of the channels have completed simultaneous slow charging successfully. The ^ indicates the "UP" SHIFTED process. They are all ready to be unplugged and used.

5. SUMMARY SCREEN FOR DISCHARGED BATTERIES

```
-------------------------
| Dischrgd 4 5 6        | CASP
| Look at  2 3          | SCREEN
-------------------------
```

In this example channels 4, 5, and 6 have batteries attached which have been successfully discharged. Channels 2 and 3 have some problem needing attention.

6. SUMMARY SCREEN FOR BATTERIES FROM ANALYZE PROCESSING

```
-------------------------
|  Anlyzed 2 3 5        | CASP
| Look at  1 4          | SCREEN
-------------------------
```

The Analyze process, Charge Capacity Testing, has been successfully completed on Channels 2, 3, and 5 in this example. Channels 1 and 4 need attention. Check ampere-hour capacity on each channel using the YELLOW "HISTORY" KEY and the YELLOW ARROW KEYS.

7. SUMMARY SCREEN FOR BATTERIES FROM ^ ANALYZE PROCESSING

```
-------------------------
| ^Anlyzed 5            | CASP
| Look at               | SCREEN
-------------------------
```

In this example, the ^Analyze process, Discharge Capacity Testing, has been successfully completed on Channel 5.

APPENDIX I
SUMMARY SCREEN REFERENCE SECTION

1. UNDERSTANDING SUMMARY SCREENS

At the conclusion of battery processing on all channels, CASP "beeps" to alert the operator and displays the Summary Screen for each channel. These screens indicate for which batteries processing has completed successfully, and which are in need of the operator's attention. Further information can be obtained by pressing the YELLOW "HISTORY" KEY (see Para. G-4.4., "HISTORY" KEY).

Examples of Summary Screens following different types of processing cycles follow.

2. SUMMARY SCREEN FOR CHARGED BATTERIES

```
-------------------------
| Charged  2 4 5 6      | CASP
| Look at  3            | SCREEN
-------------------------
```

The channels listed on the top line (2, 4, 5, and 6) in the example have attached batteries which are ready to be unplugged and used--they have been successfully charged.

The channel listed on the bottom line (3) has a battery connected which has experienced an interruption of processing or a problem in processing. To determine what went wrong, access the channel with the YELLOW ARROW KEYS and then press the YELLOW "HISTORY" KEY, or press the number of the channel and then the "HISTORY" KEY. (See Section G-4.4. for a description of the "HISTORY" KEY messages.) NOTE: The "HISTORY" KEY normally displays the last process completed.

3. SUMMARY SCREEN FOR ALTERNATE CHARGED BATTERIES

```
-------------------------
| AltChrgd 1 2 5 6      | CASP
| Look at  3 4          | SCREEN
-------------------------
```

The channels listed on the top line (1, 2, 5, and 6) have attached batteries which are ready to be unplugged and used--they have been successfully sequentially slow charged. The channels listed on the bottom line (3 and 4) have batteries connected which have experienced some problem in processing. They need attention.

8. SUMMARY SCREEN FOR RECONDITIONED BATTERIES (v ANALYZE)

```
-------------------------
| vAnlyzed 1 3 4        | CASP
| Look at  2            | SCREEN
-------------------------
```

In this example batteries connected to channels 1, 3 and 4 have completed the reconditioning cycle. The battery connected to Channel 2 needs attention. Check capacity on Channels 1,3 and 4 by means of the YELLOW "HISTORY" KEY and the YELLOW ARROW KEYS.

CASP ERROR MESSAGES

1. ERROR MESSAGES OBTAINED WITH THE YELLOW "HISTORY" KEY

When processing was not properly completed, pressing the "HISTORY" KEY will show a STAR (*) in the upper right hand corner of the CASP screen, accompanied by a code indicating what the problem was.

HISTORY	(YELLOW)	Ref Charge Op* / Chan 3 00:00:00 C	CASP SCREEN

The letters "Op" on the example CASP screen indicate that the attached battery failed the "rail" test of its impedance (or equivalent resistance), either just before or during processing, or that there is an open circuit. It also shows that reFLEX charging was attempted on the battery connected to Channel 3, but that the problem would not allow the battery to be charged (C) at all, so zero time is displayed. Thus, it was an open circuit or the initial "rail" test that the example battery failed.

To determine whether it is an open circuit or a rail test failure, press the channel number and then the volts Key. If there is voltage, it failed the rail test; if there is no voltage, there is an open circuit.

HISTORY	(YELLOW)	Discharge St* / Chan 1 00:02:54 D	CASP SCREEN

"St" stands for stop and indicates that someone interrupted processing before it was complete. It also shows that the battery connected to Channel 1 was discharged (D) for 2 minutes and 54 seconds before processing was stopped.

HISTORY	(YELLOW)	Discharge Sh* / Chan 3 00:00:00 D	CASP SCREEN

The code "Sh" indicates a short in the output--presumably in either the battery or the cable. It also shows that the battery connected to Channel 3 was not discharged (D) at all, as no time is displayed.

HISTORY	(YELLOW)	Alt Charge Rp*	CASP
		Chan 3 00:00:00	SCREEN

"Rp" stands for reversed polarity. Either the battery is connected backwards or its polarity is reversed due to an unusual condition.

HISTORY	(YELLOW)	Ref Charge Ot*	CASP
		Chan 6 00:00:01 C	SCREEN

If the code "Ot" appears when processing a battery with a compatible, properly working, third wire, temperature sensing capability, it stands for battery over temperature. This sensing capability is used as a back-up to CASP's computer sensing.

ALTERNATELY, "Ot" CAN INDICATE THAT THE BLUE THIRD (TEMPERATURE SENSING) WIRE HAS AN OPEN CIRCUIT: MAKE SURE THAT THE BLUE WIRE IS CONNECTED TO THE RED WIRE IF THE BATTERY DOES NOT HAVE A COMPATIBLE THIRD TERMINAL.

This example shows that the battery connected to CASP's Channel 6 received only one second of reFLEX charging (C).

HISTORY	(YELLOW)	Ref Charge Ti*	CASP
		Chan 5 00:22:00	SCREEN

The code "Ti" stands for over time. The reFLEX charging of the battery connected to Channel 5 exceeded the maximum time programmed for it, as a backup shutoff. The CASP did not reach computer cutoff in the maximum time allowed for it. This may indicate that there is something wrong. A new battery or one out-of-service for some time can cause this code to appear. If you believe that there is nothing wrong and if the battery is cool, disconnect it, then reconnect it to re-start charging.

WARNING: IF YOU RE-START CHARGING, YOU MUST MONITOR THE BATTERY FOR ANY ABNORMAL SIGNS DURING THIS ENTIRE SECOND ATTEMPT AT CHARGING. IF THE COMPUTER DOES NOT TERMINATE THE CHARGE WITHIN 20% OF THE TIME IT FIRST SHUT OFF (4.4 MINUTES, IN THIS EXAMPLE), DISCONNECT THE BATTERY AND INVESTIGATE THE PROBLEM.

NOTE: Ovetime may have been reached due to an overtemperature condition interruption.

2. OTHER ERROR MESSAGES

```
-------------------------
|      Illegal Entry    |
|                       |
-------------------------
```

When an operator or a programmer tries to enter something that CASP does not recognize, this error message will be displayed. Press any yellow or blue key, or UP-SHIFT then STOP to clear this message.

```
-------------------------
|      Illegal Entry    |
|   Chan 5 00:00:23 C   |
-------------------------
```

CASP is processing, using one BLUE TASK KEY function. An operator or a programmer will obtain this display if he tries to use another BLUE TASK KEY without following the proper procedure to stop one form of processing and begin another. This message will automatically go away if the display is not in the latched mode.

```
-------------------------
|  CASP V4.4a  Ok       |
|    Checksum Error     |
-------------------------
```

This screen indicates that there are hardware problems or that the system memory has been altered.

DO NOT USE THE UNIT. It needs servicing.

APPENDIX III
CASP VOLTAGE/CURRENT LIMITS

This section contains the performance specifications and graphs of the CASP's abilities.

Exceeding the limits specified may result in improper performace, damage to the CASP, or even explosion of batteries.

Input voltage : 90 to 130 VAC
180 to 265 VAC

47 to 440 HZ

Input current : 6 amps max.

Output voltage: 0 to 42 VDC.

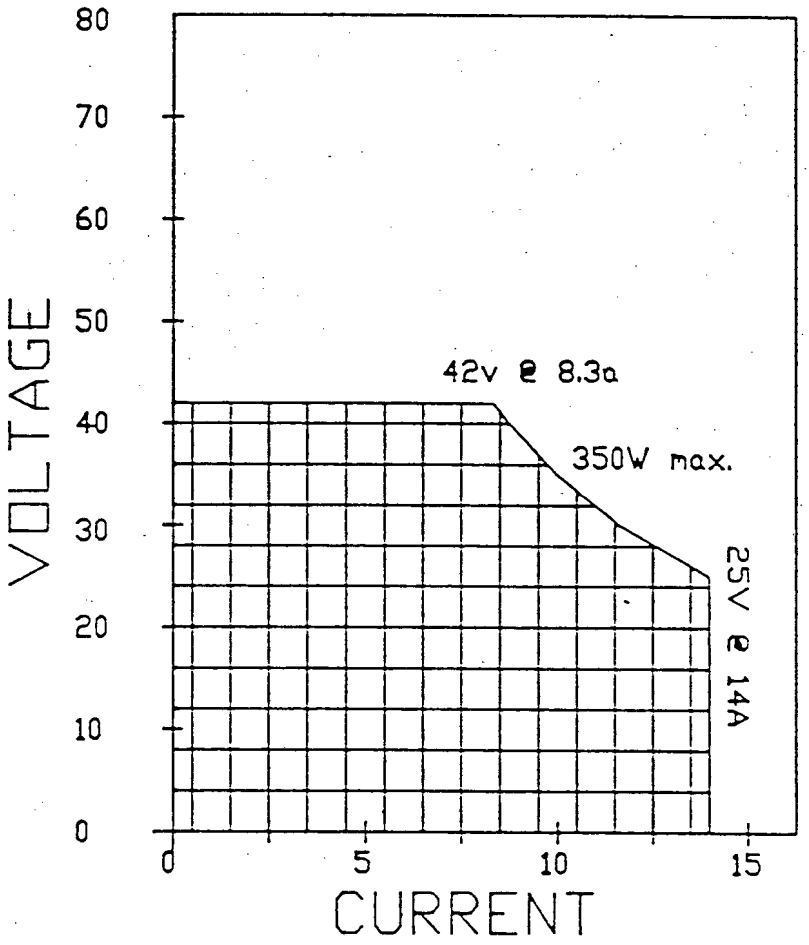
Charge current: 0 to 14 ADC, 350 watts max.

Discharge current: 0 to 4 ADC, 60 watts max.

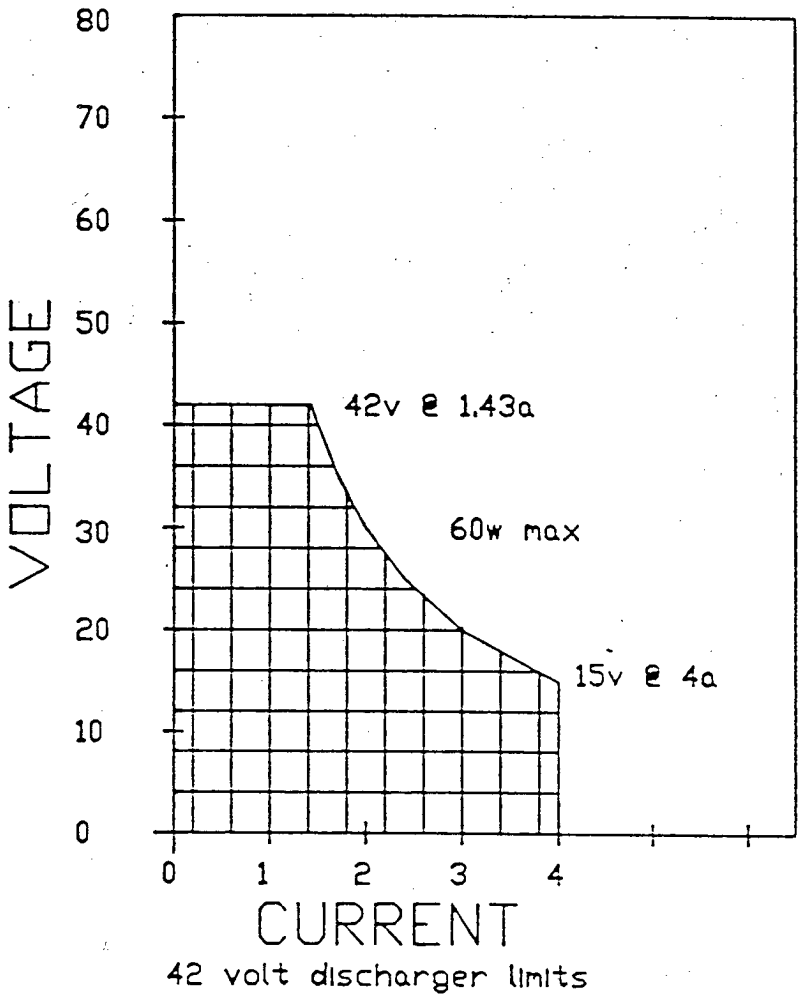
Non-operating conditions
40,000 ft. altitude.
-40 to 75 degrees C.
95% RH.

Operating conditions:
10,000 ft altitude.
0 to 50 degrees C.
95 % RH max.
vibration 2g
shock 30g
unit is not watertight, splashproof, or dripproof.

Physical characteristics
size - 4 in. high, 8.75 in. wide, 14 in. deep.
weight - 12 pounds.
color - black.
case material - anodized or painted aluminum.



42 volt charging limits



42 volt discharger limits

CASP III - High Voltage Model

Input voltage : 90 to 130 VAC
180 to 265 VAC

47 to 440 HZ

Input current : 6 amps max.

Output voltage: 0 to 78 VDC.

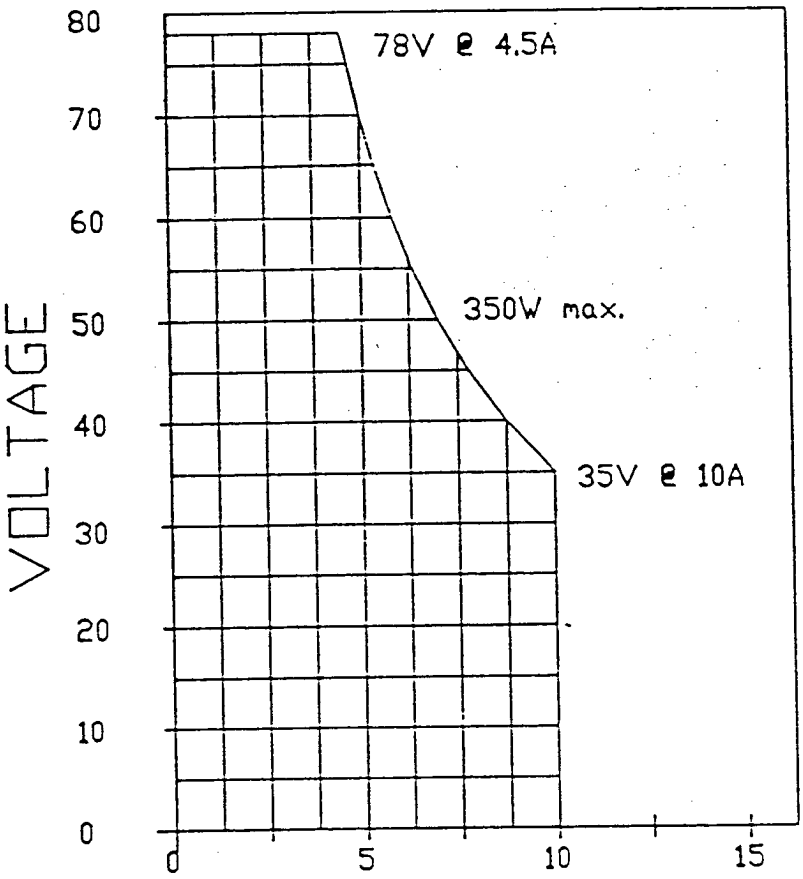
Charge current: 0 to 10 ADC, 350 watts max.

Discharge current: 0 to 4 ADC, 60 watts max.

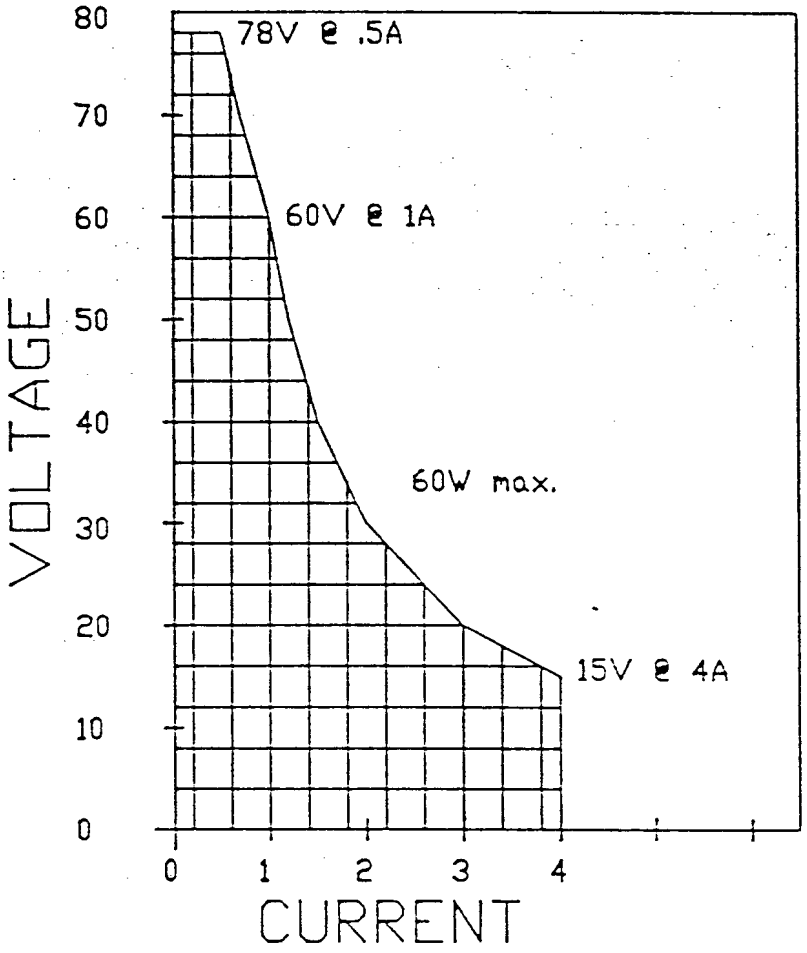
Non-operating conditions
40,000 ft. altitude.
-40 to 75 degrees C.
95% RH.

Operating conditions:
10,000 ft altitude.
0 to 50 degrees C.
95 % RH max.
vibration 2g
shock 30g
unit is not watertight, splashproof, or dripproof.

Physical characteristics
size - 4 in. high, 8.75 in. wide, 14 in. deep.
weight - 12 pounds.
color - black.
case material - anodized or painted aluminum.



78 volt charging limits



78 volt discharger limits

Input current : 30 amps max.

Output voltage: 0 to 42 VDC.

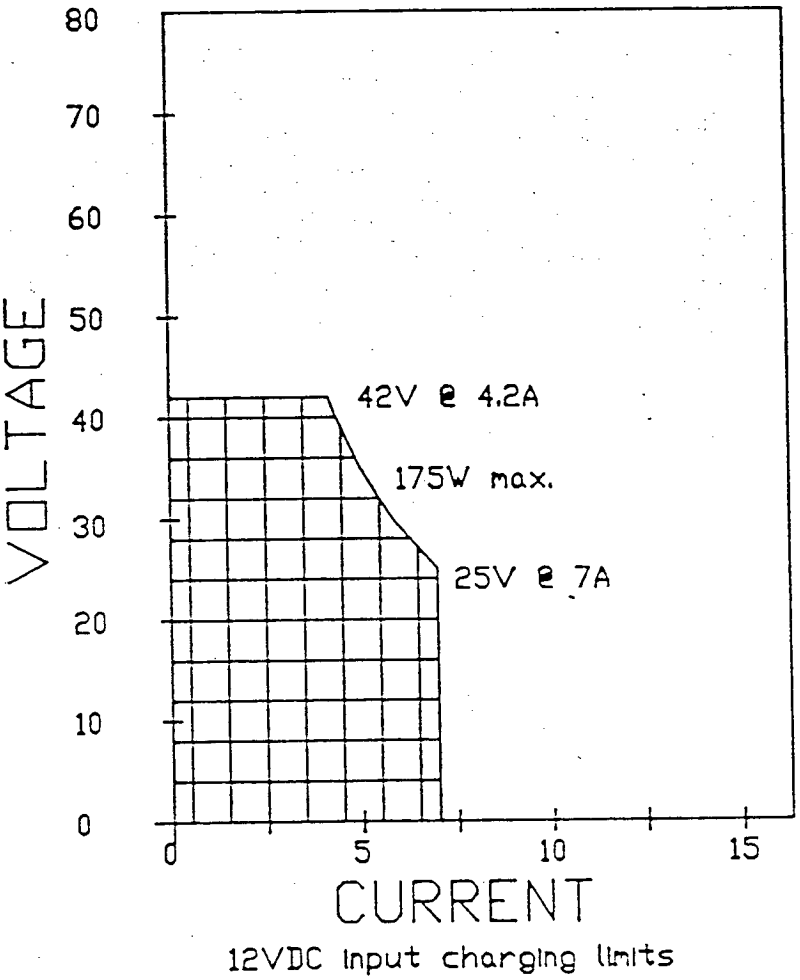
Charge current: 0 to 14 ADC, 350 watts max with 20 to 36 VDC input.
0 to 7 ADC, 175 watts max with 10.5 to 19.9 VDC input.

Discharge current: 0 to 4 ADC, 60 watts max.

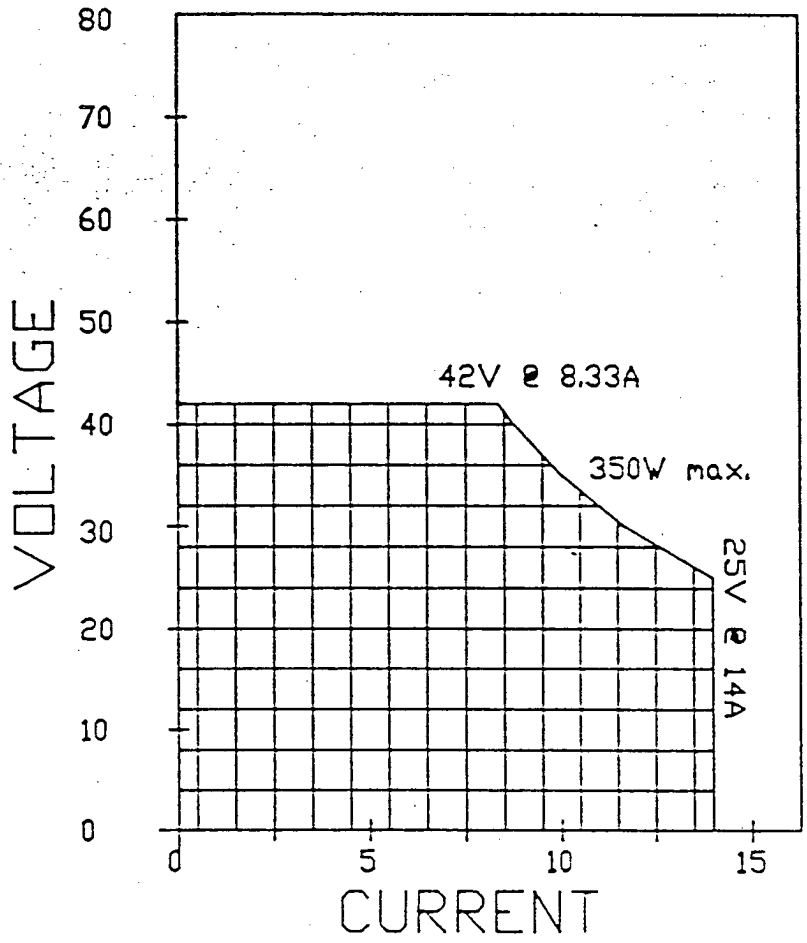
Non-operating conditions
40,000 ft. altitude.
-40 to 75 degrees C.
95% RH.

Operating conditions:
10,000 ft altitude.
0 to 50 degrees C.
95 % RH max.
vibration 2g
shock 30g
unit is not watertight, splashproof, or dripproof.

Physical characteristics
size - 4 in. high, 8.75 in. wide, 14 in. deep.
weight - 12 pounds.
color - black.
case material - anodized or painted aluminum.



12VDC Input charging limits



24VDC Input charging limits

APPENDIX IV
QUICK REFERENCE GUIDE

Programmers password is at most 6 letters long, may not start with the following letters:

C D I L P R V

and may not contain the letter "L" or spaces at all.

One letter codes and their function:

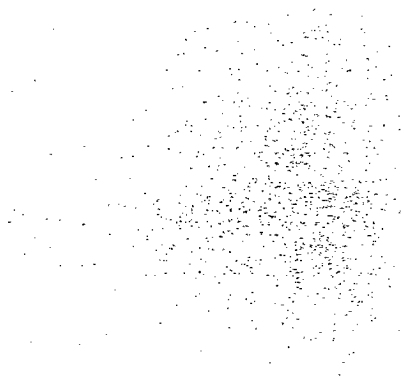
C - self test / calibration
D - initiates download
I - inspect battery tables
L - latch the display mode
P - print the display
R - enter recalibration mode
V - voltage mode

Printer specifications:

1200 BAUD
no parity
8 data bits
1 stop bit
auto line feed after CR

Serial connector (RS-232)
pin 2 - RXD into CASP
3 - TXD from CASP
6,20 - BUSY from printer
7 - GND

Battery cable connector (CASP end):
pin 1 - red #16 AWG - battery positive
2 - blue #20 AWG - TCO sense (connect to red if not used)
3 - black #16 AWG - battery minus / ID resistor return
4 - resistor lead - ID resistor



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C A S P 1

BATTERY CARE INSTRUMENT

CHARGER - ANALYZER - SEQUENCER - POWER SUPPLY

PROGRAMMER'S MANUAL

CHRISTIE ELECTRIC CORP.
20665 Manhattan Place
Torrance, California 90501, U.S.A.

PHONE: (213) 320-080

TLX/TWX 910-349-6260

Manual No. TD543-3V30
Software Version: 4.4

WARNING

1. BEFORE INITIATING BATTERY PROCESSING:

THREE THINGS THE CASP OPERATOR MUST VERIFY BEFORE USING THE INSTRUMENT TO PROCESS BATTERIES:

- -- THAT THE PROPER CABLE IS BEING USED FOR EACH BATTERY BEING PROCESSED.[1]
- -- THAT EACH CABLE NUMBER IS CALLING THE CORRECT BATTERY PARAMETER NUMBERS FROM THE COMPUTER (these set values such as the charge and discharge current).[2]
- -- THAT THE VALUES ENTERED IN THE PARAMETER TABLES ARE APPROPRIATE FOR THE BATTERIES BEING CHARGED.[2 & 3]

FAILURE TO VERIFY THESE ITEMS CAN RESULT IN EXCEEDING THE LIMITS OF THE BATTERY BEING PROCESSED, CAUSING DAMAGE TO THE BATTERY OR EVEN ITS VIOLENT FAILURE.

2. PRIOR TO ANY USE:

The operator must verify that the programmed battery processing and power supply parameters do not exceed the ratings in Appendix III. Failure to verify these items can result in damage to CASP, even though CASP has extensive self-protecting features.

3. DURING INITIAL PROCESSING:

At least when FIRST using CASP to process a type of battery not previously processed at your facility, or when using a previously untried process on a particular battery, the programmed parameters must be verified by observation: THE BATTERY MUST BE MONITORED CLOSELY THROUGHOUT PROCESSING FOR EXCESSIVE HEATING OR VENTING, ABNORMAL LOSS OF ELECTROLYTE, BULGING, OR OTHER FAULTY SIGNS.

If any faulty signs are observed, PRESS THE GREEN "UP" SHIFT KEY, AND THEN THE RED "STOP" KEY. MOVE PERSONNEL A SAFE DISTANCE AWAY.

NOTES:

1. Cable identification instructions are located in para. G-4.3.1
2. Instructions for inspecting all the Parameter Tables are in para. H-3, of the CASP Operators Manual and further described in the CASP Programmer's Manual, para. BB-3.
3. Instructions for programming all the parameter tables for a particular battery are in the CASP Programmer's Manual, sections CC, DD, and EE.

THE OPERATOR MUST BE SURE THE EQUIPMENT TO BE OPERATED IS CONNECTED TO CASP WITH CABLES MARKED "P/S" OR "098" FOR POWER SUPPLY CABLE.

WARNING: NEVER CONNECT BATTERIES TO CASP USING POWER SUPPLY CABLES.

5. FURTHER WARNINGS:

TO PREVENT ELECTRIC SHOCK, MISCALIBRATION OR DAMAGE TO YOUR CASP, NEVER REMOVE ANY COVER. THERE ARE NO USER-SERVICEABLE PARTS INSIDE. REFER ANY SERVICING NEEDS TO CHRISTIE'S QUALIFIED SERVICE PERSONNEL.

NOTICE

The specifications contained in both the CASP Operator's Manual and CASP Programmer's Manual are subject to change without notice. The contents of both these documents are believed to be accurate. If errors are found, please notify Christie Electric Corp. at the address shown on the title page.

The following is a list of trademarks used within these documents:

reFLEX is a trademark of Christie Electric Corp.

EQUIPMENT LIST

Your CASP and its external equipment consist of:

A front microcomputer module with keyboard
A rear switcher type power module for AC input
A power cord for 120VAC
Six programmable output cables of your choice
(May include one or more power supply cables)

Optional equipment available:

Additional programmable battery or power supply cables
External discharge boosters
Snap-in printer module which fits between the front and rear modules
A DC input power module in lieu of the AC module.
A high voltage version of the power module.

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SECTION AA
ABOUT CASP MANUALS

AA-1. THE OPERATOR'S MANUAL

The CASP Operator's Manual makes up the initial portion of this book and contains many of the basic explanations and definitions for understanding your CASP. Before attempting to use your CASP, you should read the Operator's Manual--particularly these portions:

WARNINGS: Page i
Section B: How Your Facility Can Use CASP
Section C: Getting Acquainted with CASP
Section D: Understanding Processing Batteries with CASP
Section E: Steps in Processing Batteries with CASP
Section I: Step-by-Step CASP Operation

AA-2. THE PROGRAMMER'S MANUAL

Your facility should designate someone familiar with the operation and care of battery powered and DC powered equipment to be responsible for maintaining the programmed values in your CASP's computer tables. This authorized person will use this CASP Programmer's Manual to access CASP's internal computer tables employing the PROGRAMMER PASSWORD.

The second portion of this book is the CASP Programmer's Manual. Both manuals are arranged to help you find the information you need. Each has an index, lists of figures and a table of contents.

AA-3

The example settings and tables are based upon the standard 42 volt CASP, and are not necessarily appropriate for other models. See appendix III under the section for your specific unit for limitations and ratings.

INTRODUCTION TO PROGRAMMING YOUR CASP

BB-1. YOUR CUSTOM, PRE-PROGRAMMED PARAMETERS

In the rear pocket of this manual is a computer print-out of the values which have been pre-programmed into your CASP's internal computer tables. Para. H-2 in the CASP COMPUTER TABLE INSPECTION SECTION, in the CASP Operator's Manual will help you interpret this print-out. Many tables are at least partially pre-programmed at CHRISTIE for your industry or application.

These pre-programmed values can be inspected on the LCD screen, but not altered, by entering the letter "I", the "Inspection" key. The YELLOW ARROW KEYS are used to step from one screen to the next. (See Para. H-3, CASP Operator's Manual).

Whether you are inspecting or reprogramming the computer user tables, they are summarized in the FIGURES in this manual. Each horizontal row in a FIGURE is one computer parameter table. When you access a particular table number, you are entering the left side of one of the FIGURES, and stepping to the right across one of the rows with each press of the YELLOW RIGHT ARROW KEY.

Check the CASP Operator's Manual, Section G, KEYBOARD REFERENCE SECTION, should you need more detailed information about any CASP key.

CASP is re-programmable to meet your needs, present and future. You can add to the internal computer tables accessed by your PROGRAMMER PASSWORD. You can also type-over any table your facility is not currently utilizing to make more room for needed rechargeable battery choices. Your PROGRAMMER PASSWORD is located in an envelope also in the rear pocket of this manual.

BB-2. TURNING ON CASP

Check to be sure the rear power switch (See FIGURE 4, Para. C-3.2., CASP Operator's Manual) is in the off position.

Plug the CASP end of the power cord into the AC input socket. Plug the other end of the power cord into the wall.

Connect cables for the batteries to be processed to the CASP channels. Hold the white dot upwards while plugging the cable into the channel connector. (NOTE: The white dot is a time saver; the connectors are keyed and cannot be plugged in incorrectly.) Connect the correct battery to each cable.

Turn on the power switch.

BB-3. ACCESSING THE COMPUTER TABLES

Press the GREEN "UP" SHIFT KEY followed by the RED "STOP CHAN" KEY to place CASP in the "Ready" or "Idle" mode. (See CASP Operator's Manual, Para. G-1., about the "STOP CHAN" KEY.) If you do not obtain the "Ready" message on the screen, repeat these steps.

To gain access to the programming tables, enter your PASSWORD by pressing the appropriate GREEN ALPHA-NUMERIC KEYS after the GREEN "UP" or "DN" SHIFT KEY, as described in the CASP Operator's Manual, Para. G-2., about the GREEN SHIFT and ALPHA-NUMERIC KEYS.

BB-4. ENTERING THE TABLE NUMBER OF YOUR CHOICE

Upon entering your PASSWORD, CASP will display the screen below. Type in the number of the computer table you wish to access, using the GREEN ALPHA-NUMERIC KEYS. You will be entering the left side of one row (a computer parameter table) of one of the FIGURES in this manual.

```
-------------------------
| Enter Table #         | CASP
|      003              | SCREEN
-------------------------
```

BB-5. STEPPING THROUGH, AND LEAVING THE COMPUTER TABLES

BB-5.1. MOVING FROM ONE SCREEN IN A TABLE TO THE NEXT

Once the computer table number you wish to access has been selected, the YELLOW RIGHT ARROW KEY is used to move left-to-right from one screen of the computer table to the next. You will be stepping across one line in one of the FIGURES.

The YELLOW LEFT ARROW KEY may be used to back up letter-by-letter, right-to-left. At the break on the left edge, between screens, pressing the LEFT ARROW KEY will access the previous screen.

When you have completed checking or changing a particular table, repeated use of the YELLOW RIGHT ARROW KEY will bring you back to the beginning Table Number Screen shown above.

To make a correction in something you have typed, press the YELLOW LEFT ARROW KEY to back up, and then type in the correction.

BB-5.3. MOVING FROM ONE TABLE TO ANOTHER, OR LEAVING TABLES

Once you have returned to the Table Number Screen, you can access a different table number for examination or changing by entering a new table number.

To leave a table in the middle, without returning to the initial screen, press the RED "STOP CHAN" KEY. You will have exited the computer tables. Then you can re-enter them using your PROGRAMMER PASSWORD again.

BB-6. ENDING A PROGRAMMING SESSION

You could turn CASP off at the power switch. This erases any information in the YELLOW "HISTORY" KEY's file.

If you wish to turn CASP off and retain the information on the currently connected batteries in the "HISTORY" KEY's file, unplug the power cord from the AC input, leaving the batteries connected. (This also saves the "HISTORY" KEY file during a power failure.)

If you turned CASP off at the power switch accidentally, you can retain the "HISTORY" KEY's file on the connected batteries by pressing the "HISTORY" KEY while turning the unit back on.

BB-7. SUMMARY OF STEPS IN PROGRAMMING

--Turn CASP on

--Enter your PROGRAMMER PASSWORD to access computer tables, as described in Para. BB-3.

--Access the BATTERY CABLE TABLE needed, according to Para. CC-4.1.

--Review the existing parameters or enter the correct parameters into that BATTERY CABLE TABLE, as in Para. CC-4.2. to CC-4.3.

--Access the appropriate SHARED PARAMETER TABLE 090 through 093 for the battery type to be processed, as in Para. DD-3.1.

--Review the existing parameters or enter the correct parameters into the SHARED PARAMETER TABLE 090 through 093 for that type of battery, as in Para. DD-3.2. to DD-3.6.

--Access SHARED PARAMETER TABLE 099, as in Para. DD-5.1.

--Review the existing parameters or enter the correct parameters into SHARED PARAMETER TABLE 099, as in Para. DD-5.2. to DD-5.6.

--Access the appropriate INDIVIDUAL BATTERY PARAMETER TABLE, see Para. EE-3.1.

--Review the existing parameters or enter the correct parameters into the INDIVIDUAL BATTERY PARAMETER TABLE. They describe the current to be used in processing, the structure of the battery and the optimum type of processing for that particular battery; see Para. EE-3.2 to EE-3.9.

--Terminate your programming session according to Para. BB-6.

--Monitor the first use of any newly entered parameters closely for signs of excessive heating or venting, abnormal loss of electrolyte or bulging, or other faulty signs.

NOTE: See Section FF, for a complete CASP programming example.

CC-1. OUTPUT CABLES

CASP comes supplied with six output cables of your facility's choice. They may be any combination of battery cables or power supply cables.

Each battery cable is marked with a number between 100 and 131. Battery cables come two ways: with a battery connector, or with color-coded leads.

If a battery cable has color-coded leads, red indicates plus (+), black is minus (-). If there is a third lead, it is blue. It will connect to a compatible battery temperature sensing terminal. If the battery has no such terminal, connect the blue lead to the red lead.

Power supply cables are marked P/S or 098. Power supply cables have two leads with alligator clips. Again, red is plus (+) and black is minus (-).

CC-2. THE THIRTY-TWO UNIQUE BATTERY CABLE TYPES

BATTERY CABLE TABLES 100 to 131 correspond to thirty-two battery cables, each with a different computer ID. Each of these tables ties an INDIVIDUAL BATTERY PARAMETER TABLE (Tables 000 to 019) to a particular BATTERY CABLE TABLE.

To establish parameters for a new battery type, you access the computer table and type in the BATTERY CABLE TABLE NUMBER on the Table Number Screen. If your CASP CABLE TABLE does not have any free numbers from 100 to 131 to enter a new battery for processing, you can choose one you do not use often and type-over it.

Para. CC-3, FIGURE 1, 32 BATTERY CABLE TABLES NUMBER 100 TO 131, contains an example of the partially programmed set of parameters for the thirty-two cables. Your custom programmed set may or may not be identical, depending on your particular industry or requirements.

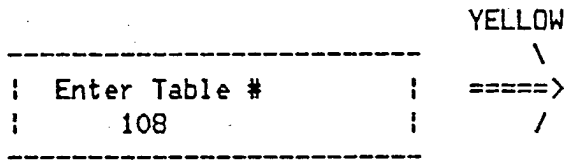
CC-3. 32 CABLE TABLES

	CABLE TABLE NO.	BATTERY NAME	INDIVIDUAL PARAMETER TABLE NO.
	100	USER ASSIGN	019
	101	USER ASSIGN	019
	102	USER ASSIGN	019
	103	USER ASSIGN	019
	104	USER ASSIGN	019
	105	USER ASSIGN	019
	106	Christie ER8	000
	107	Christie ER6	001
===>	108	Christie HR1	002
	109	Christie KR1	003
	110	Christie KR2	002
	111	Christie KS11	003
	112	Christie KS12	002
	113	USER ASSIGN	019
	114	USER ASSIGN	019
	115	USER ASSIGN	019
	116	USER ASSIGN	019
	117	USER ASSIGN	019
	118	USER ASSIGN	019
	119	USER ASSIGN	019
	120	USER ASSIGN	019
	121	USER ASSIGN	019
	122	USER ASSIGN	019
	123	USER ASSIGN	019
	124	USER ASSIGN	019
	125	USER ASSIGN	019
	126	USER ASSIGN	019
	127	USER ASSIGN	019
	128	USER ASSIGN	019
	129	USER ASSIGN	019
	130	USER ASSIGN	019
	131	USER ASSIGN	019

FIGURE 1. 32 Battery Cable Tables Number 100 to 131

The arrow indicates the example which is described in detail in section CC-4.

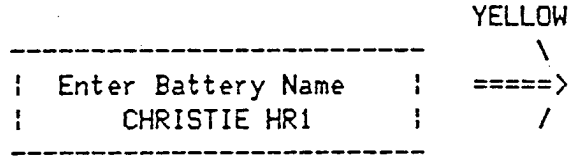
CC-4.1. STEPPING INTO BATTERY CABLE TABLE



BATTERY CABLE TABLE NUMBER 108 (for cable number 108) has been entered as an example. You will be entering the left side of FIGURE 1. Use the YELLOW RIGHT ARROW KEY to move to the next screen of the CABLE TABLE.

Check to be sure the number on the connected cable matches the number on the screen.

CC-4.2. ENTERING BATTERY NAME AND/OR MODEL NUMBER



On this screen you either check to see that the correct battery name and/or model number is entered, or type-over the "+" and the following spaces on the second line of the screen in order to enter a new battery for processing. The name and/or model number can have up to 13 characters.

If you are entering a new battery, you will have to adjust the parameter number also. See Para. CC-4.3.

Use the "." KEY to enter a space.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

CC-4.3. ENTERING THE INDIVIDUAL BATTERY PARAMETER TABLE NUMBER

```
-------------------------
| Enter Param. Table #  |
|      002              |
-------------------------
```

This step is the connection between the cable used to process the battery and the program with which CASP will process the battery.

It is essential to choose the correct INDIVIDUAL BATTERY PARAMETER TABLE. Para. EE-3 gives details necessary for this choice.

WARNING: IMPROPER INDIVIDUAL BATTERY PARAMETER TABLE NUMBER ENTERED HERE MAY RESULT IN BATTERY FAILURE, POSSIBLY VIOLENT.

When you are typing-over a new battery entry, you will have to enter the correct, appropriate INDIVIDUAL BATTERY PARAMETER TABLE NUMBER for that battery. Wherever you see "019" to the right of "+", you will have to adjust the INDIVIDUAL BATTERY PARAMETER TABLE being called out. "019" may be the correct table for some batteries, but most will need to be changed.

One set of parameters can apply to more than one battery model--ones that are similar electrically, but different mechanically.

For example, Christie models KS12, KR2 and HR1 all have 12 ni-cad D-cells. In Para. CC-3, FIGURE 1, 32 BATTERY CABLE TABLES NUMBER 100 TO 131--each of these models is entered, but the same INDIVIDUAL BATTERY PARAMETER TABLE, 002, is used for all three models. They will all be processed according to the set of parameters in the INDIVIDUAL BATTERY PARAMETER TABLE 002.

Use the YELLOW RIGHT ARROW KEY to return to the Table Number Screen.

DD-1. UNDERSTANDING THE SHARED PARAMETER TABLES

The computer tables in this section are called "SHARED" because they establish parameter sets for whole groups of batteries, such as settings common to all ni-cads or all silver-zinc batteries. These are SHARED PARAMETER TABLES numbered 090 through 093.

SHARED PARAMETER TABLE number 090 must be reserved for silver-zinc batteries or any batteries which must be charged with constant current and voltage cutoff.

Ordinarily, upon receipt of your CASP, SHARED PARAMETER TABLE 093 will be blank, enabling you to program some other group of rechargeable batteries there, as required.

Para. DD-2., FIGURE 2, contains the SHARED PARAMETER TABLES 090 through 093. Each line in FIGURE 2 corresponds to one SHARED PARAMETER TABLE. The example, stepped through from left to right in Para. DD-3, is marked with an arrow.

Another SHARED PARAMETER TABLE, 099, sets parameters for other aspects of CASP use, such as those which regulate power supply operation and the time the LCD display remains on.

Para. DD-4, FIGURE 3, shows SHARED PARAMETER TABLE 099 and Para. DD-5 contains the programming example for this table.

SHARED PARAMETER TABLE NO.	BATTERY TYPE	VOLTS PER CELL: "RAIL" MAX. VOLTS DURING CHARGE	DISCHARGE (CUTOFF) VOLTAGE	NOMINAL VOLTS PER CELL	CONSTANT CURRENT CHARGE CUTOFF VOLTAGE	CONSTANT POTENTIAL CHARGING VOLTAGE
print-out => CELL TABLES	========	1) RAIL	2) DISC	3) NOM	4) CC	5) CP
090	Silver-Zinc	2.10	1.10	1.50	2.00	2.17**
091	Ni-Cads	2.50	1.00	1.20	0.50*	1.55
092	Lead-Acid	3.00	1.80	2.00	0.50*	2.40
093	****	0.50	0.50	0.50	0.50	0.50

FIGURE 2 Shared Parameter Tables Number 090 through 093

The arrow indicates the example which is described in detail below.

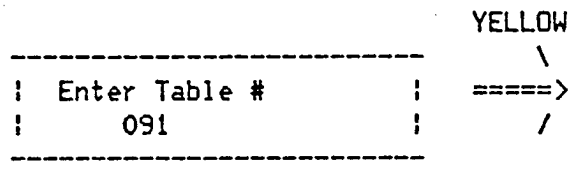
* Values in this table cannot be zero or blank. "0.50" has been entered instead.

** The value is actually an extension of table 092. It is the float voltage for lead-acid batteries, (charge code G) and is not used for silver-zinc batteries, even though it is in table 090.

**** This row has no battery group defined; battery groups to be entered as required.

NOTE: Values in this table cannot be blank or zero. "0.50" has been entered instead. The maximum range for these values is 0.50 to 3.00.

DD-3.1. STEPPING INTO SHARED PARAMETER TABLE



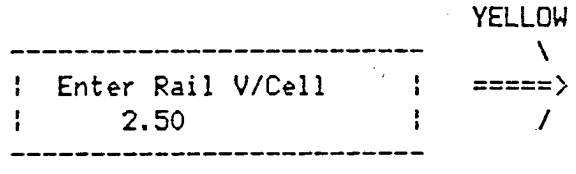
SHARED PARAMETER TABLE NUMBER 091, for processing nickel-cadmium batteries, has been entered below as an example. You will be entering the left side of FIGURE 2, as indicated by the arrow.

To determine which SHARED PARAMETER TABLE NUMBER to enter for which battery groups, see Para. DD-2., FIGURE 2, SHARED PARAMETER TABLES 090 THROUGH 093. There is no screen for "Type of Battery".

Use the YELLOW RIGHT ARROW KEY to move to the next screen of the SHARED PARAMETER TABLE.

NOTE: All entries in the shared parameter tables must contain 3 digits plus a decimal point in the form x.xx - the maximum range is 0.50 to 3.00.

DD-3.2. ENTERING RAIL VOLTAGE VALUE



The "rail" value is the maximum expected voltage per cell subsequent to a current test pulse and during charging. It is this value against which each battery's impedance is checked during the "rail test". (See also Para. D-2.1. and H-3.4. in the CASP Operator's Manual.)

CAUTION:The "rail test" is a safety factor. Ordinarily, the value on this screen should not be changed by the programmer. "Rail" voltage must NEVER exceed 3.00.

If processing repeatedly terminates for a particular battery, showing a star "*" and the letters "Op" when the YELLOW "HISTORY" KEY is pressed, it indicates that the battery has repeatedly failed the "rail test". You might consider raising the "rail" voltage slightly--if all other parameters have been verified. "Op" can also indicate an open circuit.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

```
-------------------------
| Enter CP V/Cell       |
|      1.55             |
-------------------------
```

This parameter defines the voltage per cell applied in constant potential (CP) charging.

NOTE: This value is not applicable to silver-zinc batteries (SHARED PARAMETER TABLE 090). Its location in FIGURE 2 is programmed for another use--the value entered here in TABLE 090 is the "Maintenance", or "Float", voltage used only in Category "G" charging after the cycle has completed its charging.

Press the YELLOW RIGHT ARROW KEY to return to the Table Number Screen.

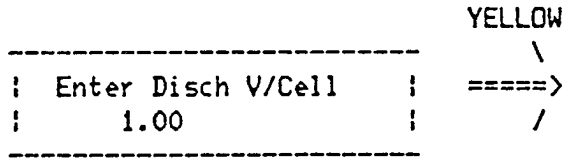
DD-4. SHARED PARAMETER TABLE 099

	SHARED PARAMETER TABLE NO.	POWER SUPPLY VOLTS	POWER SUPPLY AMPS	PAUSE TIME (MIN.)	DISPLAY WAIT TIME (1/10 SEC.)	"UP" SHIFT (*) ALT CHARGE TIME HRS.	"UP" SHIFT (*) ALT CHARGE TIME MIN.
	MISC. DATA	ITEM # 14	ITEM # 15	ITEM # 6	ITEM # 1	ITEM # 16	
printout ===>	099	13.5	10.0	001	150	14	00

FIGURE 3 Shared Parameter Table Number 099

The arrow indicates the example which is described in detail in section DD-5.

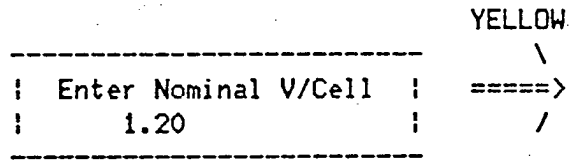
DD-3.3. ENTERING DISCHARGE VOLTAGE VALUE



This parameter defines the cutoff voltage per cell during discharge. The cutoff voltage for the battery or pack will be this value times the number of cells in the battery. For ni-cads, the discharge voltage value is about one volt per cell.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

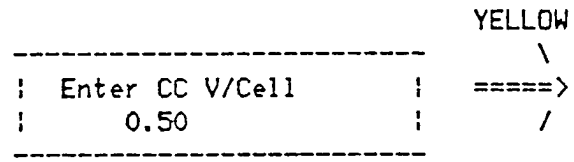
DD-3.4. ENTERING NOMINAL VOLTAGE VALUE



The number of nominal volts per cell will be printed on the battery or pack. For ni-cads, it is typically 1.2 or 1.25 volts per cell. This voltage for other types is 2 volts for lead-acid and 1.5 volts for silver-zinc.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

DD-3.5. ENTERING CONSTANT CURRENT CHARGE CUTOFF VOLTAGE VALUE

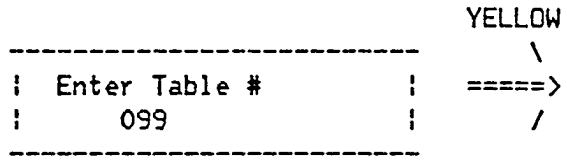


This parameter defines the voltage per cell at which charging will terminate in constant current (CC) charging. For silver-zinc batteries this value is typically 2.00 volts. For ni-cads, "0.50" is entered here, in lieu of leaving it blank.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

DD-5. PROGRAMMING EXAMPLE -- SHARED PARAMETER TABLE 099

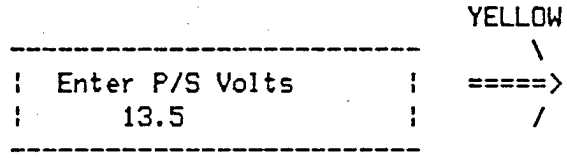
DD-5.1. STEPPING INTO SHARED PARAMETER TABLE NUMBER



SHARED PARAMETER TABLE NUMBER 099, programmed to set parameters for other aspects of CASP use, is described below.

Use the YELLOW RIGHT ARROW KEY to move to the next screen of SHARED PARAMETER TABLE 099.

DD-5.2. ENTERING POWER SUPPLY VOLTAGE VALUE

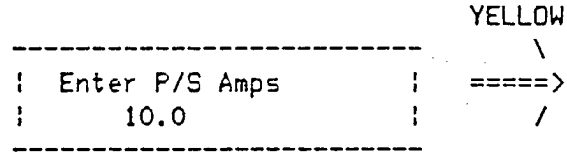


The power supply will operate at a regulated voltage of 13.5 volts. WARNING: DO NOT EXCEED THE VALUES LISTED IN APPENDIX III.

Use the YELLOW RIGHT ARROW KEY to move to the next screen of SHARED PARAMETER TABLE 099.

NOTE: All volts entry must contain 3 digits plus a decimal point in either 1 of 2 formats, x.xx or xx.x - Examples: 5 volts enter as 5.00, 28 volts enter as 28.0, 9.2 volts enter as 9.20

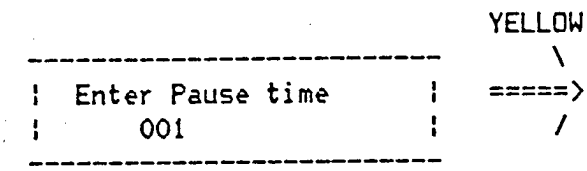
DD-5.3. ENTERING POWER SUPPLY AMPERAGE VALUE



The power supply will operate at the defined regulated voltage with 10 amperes current limiting. WARNING: DO NOT EXCEED THE VALUES LISTED IN APPENDIX III.

Use the YELLOW RIGHT ARROW KEY to move to the next screen of SHARED PARAMETER TABLE 099.

NOTE: All amps entry must contain 3 digits plus a decimal point in either 1 of 2 formats x.xx or xx.x - Examples: 5 amps enter as 5.00, 14 amps enter as 14.0, 7.5 amps enter as 7.50, 1/2 amp enter as 0.50.

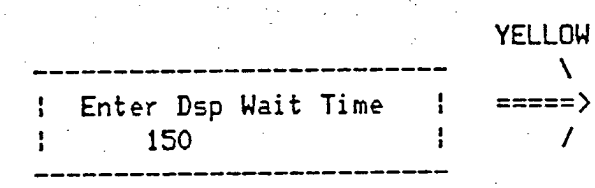


Enter the number of minutes you want CASP to pause between the discharge and the charge phases of the ANALYZING cycles available. The example shows a one minute pause. The maximum time you can enter here is 255 minutes.

Use the YELLOW RIGHT ARROW KEY to move to the next screen of SHARED PARAMETER TABLE 099.

NOTE: Pause time must contain 3 digits - kExamples: 15 minutes enter as 015, 1 hour enter as 060.

DD-5.5. ENTERING DISPLAY WAIT TIME



The CASP screen displays information for a period of time, and then turns off. On this screen you enter the time (in tenths of seconds) you would like information such as voltage, current, type or history data to remain displayed on the screen. In the example, "150" indicates that the information will be displayed for 15 seconds. The maximum number of tenths of seconds you can enter here is 255, or 25.5 seconds.

Para. G-2.1. in the CASP Operator's Manual describes how to lock the display so that it remains on.

Use the YELLOW RIGHT ARROW KEY to move to the next screen of SHARED PARAMETER TABLE 099.

NOTE: Display wait time must contain 3 digits - Example: 5 seconds enter as 050.

DD-5.6. ENTERING "UP" SHIFT, "ALT CHARGE" TIME

```
-------------------------
| Enter ^Alt Chrg Time  |
|      1400             |
-------------------------
```

This parameter defines the length of time CASP's nearly simultaneous slow charging cycle will take. This cycle is described in the CASP Operator's Manual, Para. F-4.2., in the BATTERY PROCESSING REFERENCE SECTION. It is accessed using the GREEN "UP" SHIFT KEY followed by the BLUE "ALT CHARGE" KEY (see Para. G-5.4.2., in the KEYBOARD REFERENCE SECTION, CASP Operator's Manual.)

The "^" indicates the "UP" SHIFT process.

The first two digits entered are the HOURS and the second two digits entered are the MINUTES. In the example the cycle will take 14 hours and zero minutes.

CAUTION:"UP" SHIFT, "ALT CHARGE" TIME APPLIES TO ALL BATTERIES AT THE SAME TIME. THEREFORE, THE "ALT CHARGE" CURRENT MUST BE 1/10 AH ON ALL BATTERIES.

Use the YELLOW RIGHT ARROW KEY to return to the Table Number Screen.

NOTE: ALT charge time entry must contain 4 digits. Examples: 25 minutes enter as 0025, 2 hours and 16 minutes enter as 0216, 12 hours and 30 minutes enter as 1230.

SECTION EE
CASP INDIVIDUAL BATTERY PARAMETER TABLES

EE-1. UNDERSTANDING THE INDIVIDUAL BATTERY PARAMETER TABLES

These tables apply to particular models or types of batteries, defining the battery's number of cells, ampere-hour rating, etc. However, one set of these parameters can apply to more than one battery model--ones that are similar electrically, but different mechanically. These are the INDIVIDUAL BATTERY PARAMETER TABLES, numbered 000 through 019, and shown in Para. EE-2, FIGURE 4.

It is essential to verify the parameters being set by this group of tables, as they govern the way a connected battery is processed. The INDIVIDUAL BATTERY PARAMETER TABLE number on the left side of FIGURE 4 is the identifying connection with the BATTERY CABLE TABLE you are using. It is entered in the right hand side of the BATTERY CABLE TABLE.

Your CASP unit may contain a different table from that shown in FIGURE 4, with more (or different) custom pre-programmed battery types entered. Check the print-out from the back pocket of this manual to determine exactly what has been pre-programmed into your CASP's INDIVIDUAL BATTERY PARAMETER TABLES. Para. H-2 of the CASP Operator's Manual, "Understanding Your Custom Computer Print-Out", contains the relationship between the FIGURES in this manual and the headings on the computer print-out.

WARNING: TO AVOID DAMAGE TO YOUR CASP UNIT OR A BATTERY FAILURE--POSSIBLY VIOLENT--YOU MUST:

--FOLLOW ALL THE INSTRUCTIONS HERE IN DETAIL

--KEEP THE PARAMETERS ENTERED WITHIN THE LIMITS DEFINED IN APPENDIX III

--WHEN ALTERATIONS SEEM NECESSARY, BE SURE TO FOLLOW THE GUIDELINES GIVEN AND/OR CONTACT CHRISTIE FOR ADVICE

INDIVIDUAL BATTERY PARAMETER TABLE NO.	CHARGE AMPS	DISCHARGE AMPS	ALTERNATE CHARGE AMPS	AMP HOUR	NO. OF	CHARGE CODE SEE EE-3.7			FAST/STNDRD CHARGE TIME	ALT CHARGE TIME HRS	ALT CHARGE TIME MIN
print-out => PARAMETER TABLE NO.	CHARGE CURRENT	DISCHARGE CURRENT	LOW RATE CURRENT	AMP HOURS	# OF CELLS	CHARGE CODE			CHARGE TIME	LOW RATE TIME	
000	9.0	1.13	0.23	2.25	10	A	91	M	023	16	00
001	14.0	2.00	0.40	4.00	10	A	91	M	023	16	00
002	14.0	2.00	0.40	4.00	12	A	91	M	023	16	00
003	14.0	2.00	0.40	4.00	11	A	91	M	023	16	00
004											00
005											00
006											00
007											00
008											00
009											00
010											00
011											00
012											00
013											00
014											00
015											00
016											00
017											00
018											00
019											00

FIGURE 4.a Individual Battery Parameter Tables Number 000 through 019
For standard CASP and CASP 1DC.

The arrow indicates the example which is described in detail in section EE-3.

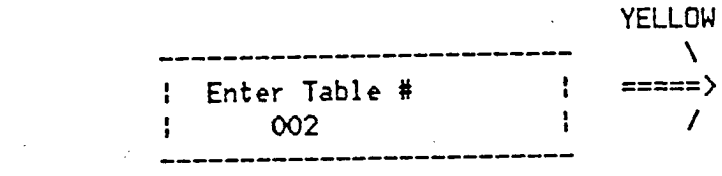
	INDIVIDUAL BATTERY PARAMETER TABLE NO.	CHARGE AMPS	DISCHARGE AMPS	ALTERNATE CHARGE AMPS	AMP HOUR	NO. OF	CHARGE CODE SEE EE-3.7	FAST/STNDRD CHARGE TIME	ALT CHARGE TIME HRS	ALT CHARGE TIME MIN
print-out =>	PARAMETER TABLE NO.	CHARGE CURRENT	DISCHARGE CURRENT	LOW RATE CURRENT	AMP HOURS	# OF CELLS	CHARGE CODE	CHARGE TIME	LOW RATE TIME	
	000	9.0	1.13	0.23	2.25	10	A 91 M	023	16	00
	001	10.0	2.00	0.40	4.00	10	A 91 M	030	16	00
	002	10.0	2.00	0.40	4.00	12	A 91 M	030	16	00
	003	10.0	2.00	0.40	4.00	11	A 91 M	030	16	00
	004									00
	005									00
	006									00
	007									00
	008									00
	009									00
	010									00
	011									00
	012									00
	013									00
	014									00
	015									00
	016									00
	017									00
	018									00
	019									00

FIGURE 4.b Individual Battery Parameter Tables Number 000 through 019 For CASP 1H.

The arrow indicates the example which is described in detail in section EE-3.

EE-3. PROGRAMMING EXAMPLE--INDIVIDUAL BATTERY PARAMETER TABLES

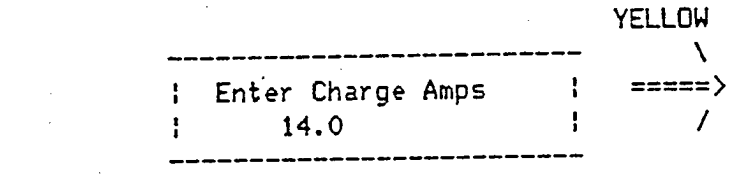
EE-3.1. STEPPING INTO INDIVIDUAL BATTERY PARAMETER TABLES



The example was entered by typing INDIVIDUAL BATTERY PARAMETER NUMBER "002" over existing numerals. You will be entering the left side of FIGURE 4, as indicated by the arrow.

Use the YELLOW RIGHT ARROW KEY to move to the next screen of INDIVIDUAL BATTERY PARAMETER TABLE 002.

EE-3.2. ENTERING THE CHARGE AMPS VALUE

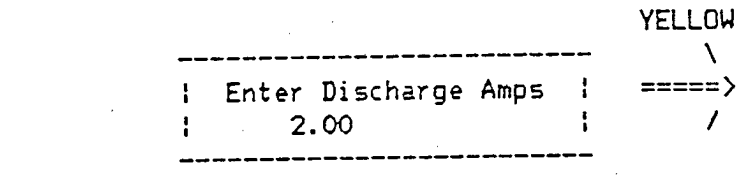


This parameter defines the amperage with which the connected battery will be charged.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

NOTE: All amp entries must be 3 digits plus a decimal point in either one or two formats x.xx or xx.x - Example: 200 amps enter as 0.20, 9.5 amps enter as 9.50, .35 amps enter as 0.35, 12 amps enter as 12.0, 4.22 amps enter as 4.22

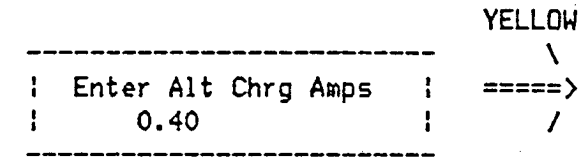
EE-3.3. ENTERING DISCHARGE AMPS VALUE



This parameter defines the amperage with which CASP will discharge the connected battery whenever that process is programmed into a cycle.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

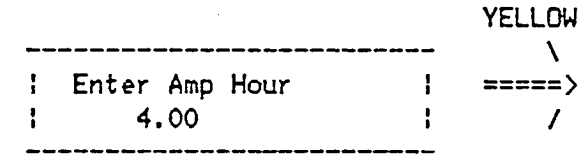
EE-3.4. ENTERING "ALT CHARGE" AMPS VALUE



When CASP is slow charging batteries with the "ALTERNATE CHARGE" method, it will use this average amperage to do so. On the next screen you enter the ampere-hour rating of the battery being programmed. The Alt Charge Amps entered here must typically be 1/10 OF THE AMP-HOUR (AH) RATING.

Press the YELLOW RIGHT ARROW KEY to move to the next screen.

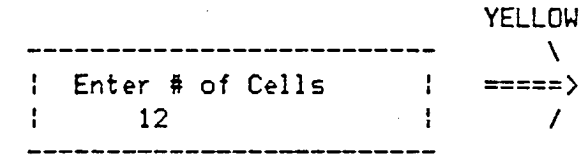
EE-3.5. ENTERING AMP-HOUR RATING OF THE BATTERY



Enter the amp-hour rating of the battery to be processed. It will usually be printed on it.

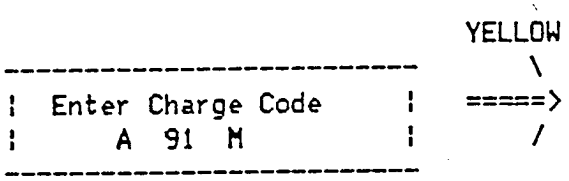
Press the YELLOW RIGHT ARROW KEY to move to the next screen.

EE-3.6. ENTERING THE NUMBER OF CELLS IN THE BATTERY



Enter the number of cells within the battery. Be sure it corresponds to the number of cells in series between the terminals connected to it. Double check by measureing the battery voltage using the YELLOW "VOLTS" KEY. It should read approximately equal to the number of cells multiplied by the nominal voltage per cell (Para. DD-3.4.). This voltage is 1.2 or 1.25 volts for ni-cads, 2 volts for lead-acid and 1.5 volts for silver-zinc. NOTE: If the number of cells is less than 10 enter a 0 first - Example: 4 cells enter as 04.

Press the YELLOW RIGHT ARROW KEY to move to the next screen in INDIVIDUAL BATTERY PARAMETER TABLE 002.



The charge code is the key to appropriate battery charging with CASP. It sets both the preferred charging method (e.g., reFLEX, constant current, constant potential) and the primary Charge Cutoff Category A-L being applied (e.g., computer state-of-charge, timed, voltage, temperature). Determining the charge code correctly is most vital. It has three parts.

PART 1. CHARGE CUTOFF CATEGORY:

Para. F-3, "CHARGE" KEY Charge and Cutoff Combinations, in the BATTERY PROCESSING REFERENCE SECTION of the CASP Operator's Manual describe the categories (lettered A through L), and the batteries to which they can be applied. They are summarized in FIGURE 5, below.

CHARGING METHOD	PRIMARY CHARGE CUTOFF METHOD					
	CHARGE CURVE		TIMED	VOLTAGE	TEMPERATURE	VOLTAGE TRIGGERED TIME
	STANDARD	MAXIMUM				
reFLEX	A	B	L	--	--	I
Constant Current	J	K	C	D	E or F	H
Constant Potential	--	--	G	--	--	--

FIGURE 5. "CHARGE" KEY Charge and Cutoff Combinations

NOTE: Categories H and I are not available in Version 4.4, but will be available in future releases.

PART 2. SHARED PARAMETER TABLE

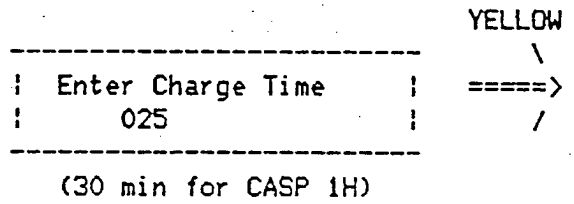
Second, the SHARED PARAMETER TABLE, 090 through 093, being used is entered.

PART 3. MINUTES OR HOURS

The next parameter to be entered (Para. EE-3.8) deals with CHARGE TIME. The letter "M" or "H" entered here, for the third part of the CHARGE CODE, indicates whether the CHARGE TIME is in minutes (M) or hours (H).

Press the YELLOW RIGHT ARROW KEY to move to the next screen in INDIVIDUAL BATTERY PARAMETER TABLE 002.

EE-3.8. ENTERING CHARGE TIME ("CHARGE" KEY CHARGING)



The charge time entered here indicates how long CASP will standard charge ("CHARGE" KEY charge) a connected battery, if not turned off earlier by the computer sensing. Then, this time is just a back-up to the primary means of terminating charging. The units are in minutes, if indicated by an "M" in the previous screen, or hours, if an "H".

The maximum number of minutes which can be entered here is 255.

If a longer time needs to be entered, the number should indicate the number of hours, and the unit, hours (H), is entered in the previous screen.

Press the YELLOW RIGHT ARROW KEY to move to the next screen in INDIVIDUAL BATTERY PARAMETER TABLE 002.

NOTE: Charge time entry must contain 3 digits. Example: 8 minutes enter as 008, 46 minutes enter as 046, 2 hours enter as 002, 165 minutes enter as 165.

EE-3.9. ENTERING "ALT CHARGE" TIME

```
-------------------------
|  Enter Alt Chrg Time  |
|       1600            |
-------------------------
```

This parameter sets the amount of time CASP will process batteries in the sequential slow charging cycle. This cycle is described in the CASP Operator's Manual, Para. F-4.1., in the BATTERY PROCESSING REFERENCE SECTION. It is accessed using the BLUE "ALT CHARGE" KEY alone (see Para. G-5.4.1., in the KEYBOARD REFERENCE SECTION, CASP Operator's Manual.) The first two digits entered are the HOURS and the second two digits entered are the MINUTES. In the example the cycle will take 16 hours and zero minutes.

Use the YELLOW RIGHT ARROW KEY to return to the Table Number Screen.

NOTE: The ALT charge time entry must contain 4 digits. Example: 5 minues enter as 0005, 1 hour 49 minutes enter as 0149, 10 hours and 5 minutes enter as 1005.

SECTION FF
COMPLETE CASP PROGRAMMING EXAMPLE

FF-1. BATTERY TO BE PROCESSED IN THIS EXAMPLE

Sealed ni-cad battery, 24-cell, 2 ampere-hours (AH), low impedance, cells not balanced for charging efficiency.

-- Name of battery: B18
-- Cable to be used: 105

FF-2. PUT CASP IN THE "Ok" MODE

To start programming, the LCD screen must indicate that the unit is in the "Ok" mode.

If your CASP is not there, press the GREEN "UP" SHIFT KEY followed by the RED "STOP CHAN" KEY to obtain that mode. If the unit is still not in the "Ok" mode, repeat the "UP" SHIFT + "STOP CHAN".

FF-3. ENTERING USER ACCESS CODE

The CASP comes with the PROGRAMMER PASSWORD "USMART" unless otherwise requested. Let's assume that this is the case.

Enter the PASSWORD by pressing the keys in the following order:

1. "DN" SHIFT KEY
2. "U" KEY
3. "DN" SHIFT KEY
4. "S" KEY
5. "UP" SHIFT KEY
6. "M" KEY
7. "UP" SHIFT KEY
8. "A" KEY
9. "DN" SHIFT KEY
10. "R" KEY
11. "DN" SHIFT KEY
12. "T" KEY

FF-4. ENTERING THE BATTERY CABLE TABLE VALUES

-- Enter "105" under Table Number.

-- Press the YELLOW RIGHT --> ARROW KEY.

-- Enter the Battery Name, by pressing keys in this order:

1. "UP" SHIFT KEY
2. "B" KEY
3. "1" KEY
4. "8" KEY

-- Press the YELLOW RIGHT ARROW KEY.

-- Enter Param. Table #, the INDIVIDUAL BATTERY PARAMETER TABLE number, as follows:

-- Check whether any INDIVIDUAL BATTERY PARAMETER TABLE in Para. EE-2, FIGURE 4, already includes a battery with the characteristics of a B18, as described in Para. FF-1.

-- If not, enter "017", an empty TABLE number in Figure 4.

FF-5. ENTERING THE SHARED PARAMETER TABLE VALUES

-- Enter "091", the SHARED PARAMETER TABLE for ni-cads, on the Table # screen.

-- Use the YELLOW RIGHT ARROW KEY to step from value to value.

-- Check that the values are proper, or modify them according to Section DD.

-- The values are OK for this battery.

-- Enter "099" when you are back to the Table # screen to access SHARED PARAMETER TABLE 099.

-- Assume all values are OK, except for the Display Wait Time, where you want 10 seconds, in lieu of 15 seconds.

-- Use the YELLOW RIGHT ARROW KEY four times to step from value to value.

-- Type "100" over the "150", changing the Display Wait Time to 10 seconds.

-- Press the YELLOW RIGHT ARROW KEY twice to get back to the Table # screen.

FF-6. ENTERING THE INDIVIDUAL BATTERY PARAMETER TABLE VALUES

-- Enter "017", as selected in Para. FF-4.

-- Press the YELLOW RIGHT ARROW KEY.

-- Enter "2.00" for the Charge Amps (or 1 x the AH rating), which does not exceed the CASP rating in APPENDIX III, under Charge Current.

-- 1 times the AH rating is the largest current recommended for most non-Christie batteries. It assumes that the battery uses low impedance (resistance) cells and that internal wiring and connectors will handle 2 amps. If not, make first test at 0.5 times AH rating. Reduce further, if battery heats excessively.

WARNING: WATCH CAREFULLY (AT LEAST DURING THE FIRST TIME THE BATTERY IS CHARGED FROM DISCHARGE TO FULL CHARGE) FOR ANY POSSIBLE OVERHEATING, EXCESSIVE VENTING, ABNORMAL LOSS OF ELECTROLYTE OR BULGING, OR OTHER FAULTY SIGNS. (BATTERY SHOULD BE COOL AT START OF CHARGE FOR THIS TEST).

IF UNSATISFACTORY, CURRENT MUST BE LOWERED UNTIL BATTERY STAYS COOL UNDER CHARGE, AND OTHERWISE SATISFACTORY RESULTS ARE OBTAINED.

-- Press the YELLOW RIGHT ARROW KEY.

-- Enter "1.00" for the Discharge Amps (for 2-hour rate), which is OK according to APPENDIX III, or a lower current value.

-- Usually, the highest discharge rate will heat the battery somewhat, but not excessively.

CAUTION: Use "2" amps (the 1-hour rate) only if the battery stays cool during such discharge.

-- Press the YELLOW RIGHT ARROW KEY.

-- Enter "0.20" for the Alternate Charge Amps (or 1/10 the AH rate, usually referred to a C/10), which is OK according to APPENDIX III.

-- Press the YELLOW RIGHT ARROW KEY.

-- Enter the Amp-Hour rating of the battery, or "2.00".

-- Press the YELLOW RIGHT ARROW KEY.

-- Enter "24" for the Number of Cells.

-- Press the YELLOW RIGHT ARROW KEY.

-- Enter the Charge Code, "A91M", determined as follows:

-- Category A is chosen from Para. F-3, "CHARGE" KEY Charge and Cutoff Combinations, and FIGURE 5 in the BATTERY PROCESSING REFERENCE SECTION of the CASP Operator's Manual.

-- From Section DD, charging a ni-cad battery requires Table 091.

-- The M stands for "minutes" and applies to the next parameter, Charge Time, below. It is in "minutes", rather than "hours".

— Press the YELLOW RIGHT ARROW KEY.

-- Enter "080" for Charge Time, as a backup turn-off.

-- If charging at a current less than 1 times the ampere-hour rating, this value needs to be increased proportionally.

-- In reFLEX charging of sealed ni-cads (Charge Categories A and B), charge turn-off occurs normally when the computer senses the state-of-charge of the battery, not by time. Time is used only as a backup in this case.

-- If these values are consistently insufficient (such as batteries whose capacity exceeds rated capacity), the values may be increased slightly. Since this value is an important safety backup, do not increase it unless it is insufficient with other than new batteries, and other than batteries which have not been used for some time.

— Press the YELLOW RIGHT ARROW KEY.

-- Enter "1400" (or 14 hours and 00 minutes) as Alt Charge Time, determined as follows:

ALT CHARGE CURRENT	ALT CHARGE TIME	ENTER
AH/10	14 or 16 hours	1400 or 1600
AH/5	7 or 8 hours	0700 or 0800

FF-7. ENDING PROGRAMMING

-- Assuming programming has been completed, press the RED "STOP" KEY (not SHIFT + "STOP") to exit the programming tables.

-- Unit will be ready to "standard" charge, discharge, analyze, recondition or slow charge the B18 battery described in Para. FF-1.

-- Press the YELLOW "TYPE" KEY to verify the name, nominal ampere-hours, number of cells and nominal volts just programmed for Cable Number 105.

SECTION GG
RECALIBRATING YOUR CASP

Your CASP will need to be recalibrated every six months as part of regular maintenance. Upon replacing any printed circuit board, recalibration is also necessary.

GG-1. EQUIPMENT REQUIRED FOR RECALIBRATION

-- #116 cable with alligator clips

-- Regulated DC Power Supply (at least 0-40 volts)

-- 4 1/2-digit Digital Voltmeter (such as Fluke 8050A)

-- 3 1/2-digit Digital Current Meter with a 10 amp scale (such as Fluke 8010A)

GG-2. TYPE AND ATTENUATOR CALIBRATION

-- Enter the RECALIBRATION MODE by pressing the "R" KEY.

-- Connect the test cable #116 to Channel 1. Press "TYPE" key.

-- Press "1" key. Display will show Channel 1 voltage.

GG-3. CHANNEL VOLTAGE CALIBRATION

-- Set the voltage supply to output 40.00 volts.

-- Adjust the CASP display to 40.00 volts, using SHIFT <- or SHIFT -> for coarse adjustment, and <- or -> for fine adjustment.

-- Press the "STOP" key. Screen will display "RECALIBRATION MODE". Press the "0" KEY.

-- Set the voltage supply to 20.00 volts.

-- Adjust the CASP display to 20.00 volts as before.

-- Press "STOP". Press "2". Connect test cable to channel 2.

-- Using the YELLOW ARROW KEYS along with the SHIFT KEY, adjust the CASP display to 20.00 volts.

-- Repeat the last two steps for the remaining Channels (3 - 6).

GG-4. POWER SUPPLY CABLES.

-- Be sure SHARED PARAMETER TABLE 099 is programmed for 25.0 V and 14.0 Amps in the Power Supply Mode.

-- Press "STOP". Connect a Power Supply (P/S) cable to Channel 1. Press "R". Press "9".

-- Connect the end of the P/S cable to the specified Digital Volt meter, set up to read at least 25 volts.

-- Using the YELLOW ARROW KEYS along with the SHIFT KEY, adjust the voltage as displayed on the DVM to 25.00 volts.

-- Press "STOP". Press "8".

-- Using the YELLOW ARROW KEYS along with the SHIFT KEY, adjust the CASP volts display to 25.00.

-- Press "STOP". Press "7".

-- Connect end of P/S cable through the specified Digital Current Meter to a load which is set up for 7 amps at 25 volts.

-- Using the YELLOW ARROW KEYS along with the SHIFT KEY, adjust the CASP amps display to match the Digital Current Meter.

-- Press the "STOP" KEY twice.

-- Repeat the Type and Attenuator Calibration.

-- Press "STOP". Recalibration is complete.

SECTION HH
SEPARATING THE CASP MODULES

CASP modules may be separated to change from an AC input power module to a DC input power module. Or, they may be separated to insert the CASP snap-in printer.

CASP modules are not to be separated by anyone but an authorized CASP programmer.

HH-1. STEPS IN SEPARATION

-- Disconnect input cables.

-- Disconnect output cables.

-- Turn CASP off. Work on a secure, hard surface.

-- Vertical latches are located on each side of CASP, at the division between the modules.

-- Place your thumbs on the latches and press downwards -- until the latches have moved to horizontal.

-- Tilt the front module forward. There is a connector located between the two parts. Care must be taken not to damage it.

HH-2. REASSEMBLY STEPS

-- Place the latches in the horizontal position.

-- Move the front and rear modules together, barely engaging the two halves of the connector.

-- Press the thumb latches upwards to their vertical position.

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