S E R V I C E N O T E

SUPERSEDES: None

HP 5071A Primary Frequency Standard

Testing Internal Battery Capacity

Serial Numbers: 0000A00000 / 9999A99999

To Be Performed By: Customer

Parts Required: None

Commonly-asked questions about the HP 5071A internal batteries

The Hp 5071A contains a pair of lead-acid batteries that are intended provide up to 45 minutes of power when external ac and dc are absent. Two very common questions asked are "How do I know my internal batteries are fully charged?", and "how long will they actually operate when needed?" Unfortunately, there are no easy answers to these questions. This note is provided to assist in establishing a user maintenance program to ensure that those batteries are ready when needed.

Lead-acid batteries in the HP 5071A

Lead-acid batteries are designed for occasional usage and long periods of continual trickle charging currents. Unlike Nickel-cadmium batteries, they are not designed for continual deep discharge/charge usage. This makes Lead-acid the ideal choice for typical constant operating installations of the HP 5071A. They will last much longer in a full-charge state and provide more reliable capacity when they are needed.

Continued

DATE: January 1996

ADMINISTRATIVE INFORMATION

SERVICE NOTE CLASSIFICATION: **INFORMATION ONLY**		
AUTHOR:	ENTITY:	ADDITIONAL INFORMATION:
DC	0200	

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Continual power cycling is not recommended

Because of the long-term storage design of lead-acid batteries, we do not recommend that the HP 5071A internal batteries be used in situations where power is removed on a daily basis. If this is your situation, the internal batteries will be constantly subjected to discharge and possibly not receive the necessary full 16 hours re-charge during each typical work day. Such repeated partial charge and discharge cycles can permanently damage the Lead-acid battery storage capacity. If you need to operate the HP 5071A under these conditions, it is recommended that one of the two following processes be used to ensure that the batteries not be stressed by over-use and undercharging:

a. Either press the "BATTERY DISCONNECT" switch on the rear panel each time the power is turned off, or

b. Disconnect the battery wires (inside the rear door) to completely remove them from use.

Description of HP 5071A Power source priorities

The Power Steering Logic assembly (A11) automatically determines the selection of power source and the correct charging rate for the internal batteries. Here is a brief description of the major function of the A11 assembly:

1. The A11 Power Steering Logic assembly prioritizes all sources of external and internal power by the following hierarchy: ac mains, external dc, internal batteries. The presence or absence of these sources is automatically detected and the HP 5071A is switched to the next available source.

2. When ac mains voltage is present, it is used as the primary source of power (regardless of any External dc connection). A very important point is that ac mains is the only source for charging current to the internal batteries. The charging current is controlled as follows:

   a. When the internal batteries' combined terminal voltage is low, the charge current is approximately 175mA.

   b. When the internal batteries' combined terminal voltage reaches a level of about 32.4Vdc, the charge current is automatically reduced to a trickle current of a few milli-Amperes. This will allow the internal batteries combined terminal voltage to float down to about 28.2Vdc.

   c. The internal batteries must be connected to ac mains for at least 16 hours after being used, for full charge to be restored.

3. When External dc is the only external power source, the HP 5071A is powered from that source as long as it is at least 22Vdc. However, the internal batteries receive NO charging current. If your HP 5071A is always operated only on external dc, the internal batteries will eventually drain to a state of no charge. In this mode of operation, we recommend that the internal batteries be disconnected (inside the rear battery door) until ac mains power can be re-connected.

4. When both ac mains and external dc are not able to provide power, fully-charged internal batteries will provide power to the HP 5071A for at least 45 minutes Then the batteries will be automatically switched out of the circuit when their series voltage drops below approximately 19Vdc.

The 5071A does not have a battery "meter" indication

Predecessor products HP 5061A and HP 5061B utilized internal Nickel-Cadmium batteries as an option. In those cases, a meter position switch "BATTERY" would indicate a nominal value that represented the terminal voltage of those batteries. However, it is important to note that this voltage was either the charging voltage (when connected to ac mains) or the terminal voltage of the batteries themselves when in use. Voltage is not a true indicator of battery capacity. This is why no battery "meter" indication was included in the HP 5071A.

A definition of battery capacity

Battery capacity is a measure of the amount of current available from a battery over a given period of time. The unit of capacity is the ampere-hour (Ah), which is the product of amperes and hours due to the reciprocal relationship between the two. That is, a 2.5A-h battery can theoretically deliver 2.5 amperes of current for one hour, or 250 milliamperes for 10 hours. The capacity and terminal voltage of a lead-acid battery are temperature-dependent and terminal voltage is correlated with capacity in a non-linear fashion. Therefore voltage alone is a very poor indicator of how well a battery will function under load.

The HP 5071A status log is a guide to complete battery charging

Whenever power switches from ac mains to internal battery and back, the internal Status Log is updated with a message and the date/time of that event. This message can appear as one of the two:

LOG XXX OF MJD nnnnn hh:mm:ss
POWER SOURCE IS: BATT

- or -

LOG XXX OF MJD nnnnn hh:mm:ss
POWER SOURCE IS: AC

Using the above information, it is possible to determine how long the internal batteries have been in use. To determine this, look at the day/time difference from the last "POWER SOURCE IS BATT" message in the Status Log to the current time on the display, being sure that there was no interruption of power and/or reset of day/time during that period.

It is also possible to determine how long ac mains power was present (batteries re-charging) since their last usage. To determine this, look at the day/time difference from the last message in the Status Log (this can most often be a "POWER SOURCE IS AC" or "Lock Completed" message) to the current time on the display, being sure that there was no interruption

of power and/or reset of day/time during that period. This is valuable information to ensure that the batteries receive at least 16 hours of charge before they are re-used.

NOTE

The HP 5071A Status Log does not record transitions from External dc to internal batteries because External dc does not provide any charging current. Transitions from ac to External dc are logged, but are not significant to internal battery usage.A PROCESS TO ENSURE THAT THE HP 5071A BAT TERIES ARE READY FOR USE

The best process to ensure that your internal batteries are capable of providing adequate backup power to the HP 5071A is to purposely put them into use. This can be accomplished as follows:

1. Be sure that the HP 5071A has been connected to ac mains for at least 16 hours.

2. If your HP 5071A is being used in a time-keeping function, first be sure to transfer time to a reliable backup source. Be sure to consider the following when selecting this backup source:

   a. This backup source should be able to maintain the same time accuracy for at least an hour.

   b. This backup source should be accurately synchronized to the 1PPS signal from the HP 5071A.

   c. This backup source should be capable of transferring a 1PPS pulse back to the HP 5071A.

3. Set the correct time-of-day on the backup source after any synchronization.

NOTE

In the following step DO NOT press the "BATTERY DISCONNECT" switch. Let the internal batteries provide power.

4. Disconnect all source(s) of external power from the HP 5071A and monitor how long it continues to operate.

5. Avoid using the internal batteries for longer than the specified time of 45 minutes. If the HP 5071A continues to operate after 45 minutes, re-connect ac mains before the internal batteries are completely exhausted. This will ensure that timekeeping is maintained without interruption.

6. If the HP 5071A should lose internal battery power before 45 minutes have elapsed, first replace the batteries with new HP P/N 1420-0514 batteries only. Then follow procedures in the Operating Manual for assistance in re-applying power and synchronizing the Hp 5071A from the backup source.

If the above procedure is not practical for your installation, we recommend that you replace the batteries every five (5) years with a fresh set. Each HP 5071A uses two (2) Hp P/N 1420-0514 batteries. these can be ordered through any HP Sales or Service facility.

Whenever fresh batteries are installed the HP 5071A must be connected to ac mains to charge the newly-installed internal batteries for at least 16 hours before they will be able to provide a full 45 minutes of backup power.