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TITLE: Boonton Model 4400A/4500A Instrument Security Procedures **QSP-09-004 REV. NEW**

Non-volatile storage. The Boonton 4400A/4500A Powermeters use four types non-volatile storage for key parameters. Different storage media are used for different types of data.

A solid-state disk (flash EPROM) is used to store the operating firmware. This firmware consists of about half a dozen files which are loaded at the factory or by the user from an installation diskette. It is not modified during normal use.

And EEPROM located on the system motherboard is used to store instrument ID, serial number, build and calibration dates, and options information. This EEPROM can only be written to in the factory using special software, and has no user information stored.

A solid-state disk (flash EPROM or battery-backed-up SRAM) is used to store user information that must be retained during power-down. This information includes: sensor autocal tables (saved each time a sensor is autocal is performed by the user), user-saved "reference" waveforms, user-saved instrument setups, the VGA color palette table (saved when a user reprograms the display colors), and the "last used" instrument setup (saved after five seconds of keyboard inactivity).

A floppy diskette is used to save plot files, waveforms, and instrument setups. These actions will only take place if a floppy disk is in the front-panel drive when the appropriate key is pressed.

User data. Of this list, the only items which could reveal any information about the signal being measured would be: instrument setup, plot files or stored waveforms. Following are comments and recommendations for securing data of each type.

Plot files are HPGL or PCL format, and can only be saved to floppy disk. If any diskettes used during instrument evaluation are removed from the drive and destroyed or secured, the data will be protected.

Signal waveforms can be saved to floppy disk or NVRAM. If saved to disk (must be saved to an NVRAM "reference channel" first), the floppy data can be protected by securing the diskette on which it is contained. It may not be possible to secure the NVRAM waveform data once it has been written. For this reason, *we recommend against saving waveforms to the reference channels*. A method for disabling this action is discussed below.

Instrument setups can be stored both explicitly and automatically. Either of these actions stores the entire operating setup of the instrument (including timebase, trigger settings, channel parameters), but no measurement data. Explicit storage occurs when the user saves the current setup configuration to either NVRAM or floppy disk. Automatic storage of the current configuration to NVRAM occurs after five seconds of keyboard inactivity to allow the instrument to boot in the same state it was in when power was shut down. It may not be possible to secure NVRAM setup data once it has been written. For this reason, *we recommend against saving the instrument setup to NVRAM*. Saving the setup to floppy should be acceptable, provided the floppy data is secured appropriately. A method for disabling both explicit and automatic storage to NVRAM is discussed below.

Securing data already written. Depending on when the instrument was built, the NVRAM can reside in one of two physical locations: a battery-powered SRAM "disk" on the main CPU board, or in the flash EPROM "disk" (same one containing the firmware) on the main CPU board.

Type 1 ("Axiom" CPU board): Since instruments with this board use battery powered SRAM memory for NV storage, it is possible to physically remove the memory chip from its socket and install a replacement. Since the chip has an integrated battery, there is no way to simply "erase" the data. However, since internal servicing should only be performed by factory personnel, an alternative that can be performed in the field is to reformat the SRAM disk, which writes a data byte value of 255 into each data location on the SRAM disk. This will overwrite and destroy any data on the SRAM disk. A verify read follows the format operation. Formatting the SRAM disk can be most

easily done by reinstalling the operating firmware from a floppy diskette. A firmware diskette is supplied with each instrument.
Type 2 ("MCSI" CPU board): Since instruments with this board use FLASH memory for NV storage, it is possible to physically remove the memory chip from its socket and install a replacement. Please note, however, that this is a procedure that must be performed by qualified factory personnel, and should not be performed in the field. Due to the way data is written to a flash disk, it is not possible to guarantee that reformatting the drive will erase the data, so there is no field procedure for securing data already written.

Protecting NVRAM from data write. A safer method of protecting sensitive waveform and setup data is to prevent it from being written in the first place. It is possible to create a condition in the file system that will cause the write operation to fail, and keep the data from being saved. This can be done by creating a file of the same name as the file being written in the NVRAM disk directory, and setting the files "read-only" attribute bit. There is a fixed set of filenames that is used, and if all these files exist on the disk and are write-protected, the instrument will not be able to save any data. This write failure will be transparent to the user, but it is possible to list the NVRAM file directory or dump files to a floppy to be certain.

The filenames used are as follows:

B45ANV00.INV	Current setup (saved automatically after 5 seconds of keyboard inactivity)
B45ANV01.INV -thru- B45ANV10.INV	User setup #1 User setup #10
B4500ANV.RF1	Reference channel 1 waveform
B4500ANV.RF2	Reference channel 2 waveform

To protect these files from being written, you must first allow the instrument to create all of them. This should be done before any sensitive measurements are taken. The automatic setup file should always exist.

To create the 10 stored user setups, go to the PRGM > INSTR STORE menu, and enter "1" in the SELECT box, then press STORE to write user setup #1. Repeat for user setups 2 through 10 by changing the SELECT setting.

To create the two reference waveform files, connect a sensor to channel 1 and autocal it using the procedure in the manual, then go to the PRGM > REF SAVE menu, and select CH1 for SOURCE and REF1 for DEST, the press STORE. Repeat with REF2 as the destination.

With a text editor, create a batch file called BEC_BOOT.BAT in the root directory of a blank floppy diskette containing the following lines:

```
ATTRIB +R C:\*.INV
ATTRIB +R C:\*.RF?
COPY C:\*.INV A:
COPY C:\*.RF? A:
```

The drive letters shown above are for a "Type 2" CPU board (the most common). If your board is a "Type 1", the NVRAM is still drive C: but the floppy is drive B: rather than A: so the batch file must be changed accordingly. Also, it will be necessary to have a copy of ATTRIB.COM (MS-DOS 5.00) on the floppy drive for Type 1 boards. To identify your board type, press UTIL > DISK UTIL on the keyboard; the directory on the screen will show "A:/" for a type 2 board, and "B:/" for a type 1 board.

Insert the floppy in the diskette drive and cycle the instrument power. When a floppy with this batch file is detected at boot-up, the batch file will be executed. Using this method it is possible to enter simple sequences of MS-DOS commands without a keyboard. This command sequence sets the “read-only” attribute bits for all instrument setup and reference waveform files in NVRAM. For verification purposes, the current setup and reference files are saved on the floppy.

Perform secure measurements as needed.

When secure measurements are complete, repeat steps 3 and 4 using a fresh floppy disk, but the batch file should be changed to set “-R” rather than “+R” in the ATTRIB lines. This clears the “read-only” attribute bit. The files on the disk from step 4 can be compared on a PC with the files on this disk to insure they have not changed.