

Campbell CSAT3 Sonic Anemometer

ISFF Quick Reference

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For Expert Assistance:
Ed Swiatek of Campbell
Longmont CO, 303-776-1316

1) Description:

The Campbell sonic anemometer consists of following pieces:

- Transducer head
- Electronics interface
- Combined Power / RS232 cable

The CSAT can output analog signals in addition to the serial output of research grade 3-component wind and virtual temperature values used with PAM/Aster.

2) Setup:

Setup is performed via the terminal mode serial commands. Refer the the manual for more information. The following are basic items and commands which should be used.

Set Trigger Internal Trigger (as opposed to RS232 or SDM).

Set Execution Parameter to match Trigger Frequency.

For external triggering only, the execution parameter should be equal to or slightly less than the trigger rate.

Select Single-Measurement or Oversampling Mode

Single measurement minimizes the possibility of under-estimating high-frequency signal variation and covariations. It aliases high-freq. to lower freq. but this does not compromise computed flux parameters of variances and covariances.

Oversampling averages several readings together to 10 or 20hz output and minimizes aliasing by limiting the high-freq response.

Communications Problem?: Beware sensors that REQUIRE RTS to communicate. That is the default. For ISFF use, the 'ri 1' is set, but for 'out-of-the-box' or other user's devices, that may not be the case and you must connect the sensor to a PC that passes through the RTS (DE-9, pin-7 to Csat pin-G)

To ReProgram Internal Parameter Defaults. Primarily needed to enable Sync Characters output and the internal RTS drivers.

Take lid off CSAT box

Disconnected power connector

Switch jumper P12H to 'Terminal Mode' (with connectors facing you move it from the right 2-pins to the left 2-pins)

Establish serial connection to the sonic

Connected power. Observe output messages for any problems

Commands:

T	terminal command mode (or use '&' toggle-off unprompted)
??	check operating parameters
rs 1	turn on sync characters (0=off)
ri 1	turn on internal RTS drivers (needed if rts control not available from host)
??	Verify it's set
sr2718	(to program the EEPROM)
??	Verify
D	continuous data mode (or use '&' toggle-on unprompted)

Disconnected power

Switch jumper back

establish serial connection

verify data

Terminal Mode Jumper Operation

Jumper P12H setting: left 2-pins = Terminal

Sonic automatically goes into terminal mode, and this mode allows non-volatile memory to be programmed as above.

Shift-6 Toggles output of ascii uvw values and tc for ea. axis.

Run Mode Operation

Jumper P12H setting: right 2-pins = normal setting

Sonic automatically goes into data output mode if setup

Shift-6 ascii uvw output does not work.

& Toggles terminal and data output

T terminal mode

D data mode

Typical Settings Versions 3.0a Software:

Notice near the bottom it says "rev 3.0a"

>??

ET= 10 ts=i XD=d GN=334a TK=1 UP=5 FK=0 RN=1 IT=1 DR=102 rx=2 fx=038 BX=0 AH=1
AT=0 RS=0 BR=0 RI=0 GO=00000 HA=0 6X=3 3X=2 PD=2 SD=0 ?d sa=1
WM=o ar=0 ZZ=0 DC=6 EL0=020 020 021 ELb=020 020 020 TN0=886 d TNb=986 JD= 005
C0o=-2-2-2 C0b=-2-2-2 RC=0 tlo=8 8 9 tlb=8 8 8 DTR=01740 CA=1 TD= duty=028
AQ= 10 AC=1 CD=0 SR=1 UX=0 MX=0 DTU=02320 DTC=01160 RD=o ss=1 XP=2 RF=018
DS=007
SN0247 26mar98 HF=005 JC=3 CB=3 MD=5 DF=05000 RNA=1 rev 3.0a cs=49990 &=0 os=

Typical Settings Versions 4.0s Software:

Notice near the top it says "rev 4.0s"

>??

SN0672 04jan05 rev 4.0s &=1 AC=1 AF=050 AH=1 AO=00300 ar=0 AQ= 10 BR=0 BX=0
CF=1 C0o= 0 0 0 C0b= 0 0 0 CA=1 CD=0 cs=50698 DC=8 dl=015 DM=c DR=03465
duty=024 DT=16240 ET= 10 FA=00050 FL=007 FX=038 GN=424a GO=00000 HA=0
HG=01560 HH=02700 KT=0 LG=00832 LH=00100 MA=-020 MS=-010 MX=0 ND=1 NI=2
ns=00223 OR=1 os=0 PD=2 RA=00020 RC=0 RF=00900 RH=015 RI=0 RS=0 RX=002 SD=0
SL=035 SR=1 ss=1 T0123=1000 TD=a TF=02600 02600 02600 TK=1 TO= 0 0 0 TP=t
ts=i UX=0 WM=o WR=006 XD=d xp=2 XX=00875 ZZ=0

RunTime commands to set session operating parameters:

&	toggles between unprompted & prompted mode (<i>Note this gets programmed into non-volatile memory, so be sure to use it again to re-initiate continuous data output</i>)
A2	1hz
A9	10hz
Ac	20hz
Ad	30hz
Ag	10hz (oversampling mode, 60hz sampling, 10hz out)
Ah	20hz (oversampling mode, 60hz sampling, 20hz out)
Ae	60hz
T	backdoor to terminal mode
rs 1	turn on sync characters
ri 1	turn on RTS drivers
D	back to normal / data mode

3) Calibrations and Operating System Firmware Versions:

Calibrations are specific between electronics and sensor head although in theory if a cal-file is moved to a different electronics box along with the transducer head it would work fine.

Calibrations are also specific to the Firmware Version:

Version 3.0a Better Virtual Temperature Performance: less noise

Version 4.0s Better rain performance. Contains improved algorithm for low signal/noise ratio. This couples with the new rain wicks for the transducers. The Virtual Temp. noise however goes from .002C to .03C worse.

With a sensor head attached from another unit, expect some data to appear reasonable but other data indicating '32768' will appear as the sensor attempts to recal. When booting with the internal jumper in 'Terminal Mode' the sensor performs internal testing when power is applied. If there is an inconsistency in the stored calibrations a warning message will appear indicating 'PROM Signature Error' or if the calibration file is for the wrong version, the sensor will never make it into Terminal mode and will continuously attempt to obtain sync-acq. This error could indicate that the cals have been lost, are incorrect for the attached head and/or you need to return the sensor for repair and recalibration.

How to Determine if the Cal-File is Correct:

- On startup if the cal-file was wrong there should be a warning message or in worst case you will not get sync and just a continual acq.

- Examine the status parameters. Look for the serial number value and the date next to it which will represent the correct calibration-date if the download worked (also note the software 'rev' number):

>?? For Version 3.0a look at the last line printed:

SN0247 26mar98 HF=005etc..... rev 3.0a cs=49990 &=0 os=

>?? For Version 4.0s look at the first line printed:

SN0672 04jan05 rev 4.0s &=1 AC=1 AF=050 AH=1.....etc....

- These values can also be extracted from the raw calibration files by using a hex-dump program and looking for the 'SN' string. These numbers will be the only printable values in the file. Example:

HexDump of SerNum./CalDate line from file: SN0246R.CAL |

16= 53 4E 30 32 34 36 52 ... SN0246R.27may04.

See file: CalDates.txt in the directory mentioned

4) How to Reload a Calibration File:

You must use the appropriate calibration files provided by Campbell which are specific to the software version number. The most recent calibration files are best but Campbell reports that cals can still be accurate several years later, or also be bad after several months. With the cal file the similar procedure as above can be performed using the:

ld2718 (to program the EEPROM from a file. Note the following procedure using CSI software does this....)

NOTE: Calibration files must be loaded using Firmware version 4.0s

NOTE: You must use a cable that has the RTS signal wired through to the PC! It may be best to use their original cable.

NOTE: When handling the chips, a small strip of duct-tape provides a convenient way to 'grab' the chip safely. Examine the chips carefully, the pins are prone to getting bent, and if so they must be straightened.

Disconnect Power

Take lid off CSAT box

If installed, disconnected the serializer de9 and use the direct serial connection. (not entirely necessary, but advisable)

Switch jumper P12H to 'Terminal Mode' (with connectors facing you move it from the right 2-pins to the left 2-pins)

Install V4.0s Chip if needed

On PC running Windows start pgm: CSatCom3.exe

(located in "/net/pam/pc_files/Application_Software/csats32/")

Power up Sonic, verify communications are working.

Click 'Download' Button

Select File for specific sensor and for specific Firmware:

/net/pam/doc/SENSORS/CSATsonic/CalCoefsV3.0aSoftware
files called ex: SN0540.CAL

/net/pam/doc/SENSORS/CSATsonic/CalCoefsV4.0sSoftware
files called ex: SN0540R.CAL

Wait for Download to finish. When it does you should see it 'acquire signals' and possibly go into terminal mode with the '??' style status message output, however, this may or may not happen.

Disconnect Power

For Version V3.0 chips: Carefully Install V3.0a Chip

Reconnect power, verify communications are working.

Check and/or Reset the RTS/Sync char settings:

?? In terminal mode this shows you the settings

ri 1

rs 1

sr2718 reprograms the ee

Disconnect Power

Move Jumper back to the right 2 pins (run mode)

Power up Sonic. It should come up, acquire signals and run

T to get into terminal mode

shift-6 toggles into ascii output, verify temp, etc OK

D or & to set the sonic to automatically come up running

Ax to set the sampling rate.

5) Cabling:

The CSAT3 electronics box was modified so only 1 cable is needed for power and data.

NDAQ - Wiring via Bulgin Connector:

TABLE 1. NDAQ Wiring

Signal	CSAT Connector Pin	Bulgin Pin	Cable-Wire	Color
Tx Data from Csat to NDAQ	B	6	C	White bundled w/
RTS	G	4	D	black
CTS	H	3	E	Brown bundled w/
Rx commands from NDAQ	C	5	F	Orange
Ground	E	7	G	Yellow
+12	D	1	A	Red, non-shielded
Pwr Ground	F	8	H	Black, non-shielded

Serializer Wiring inside CSAT Housing:

Serial Wiring Via CSAT 'Comm' Connector ...to Data System

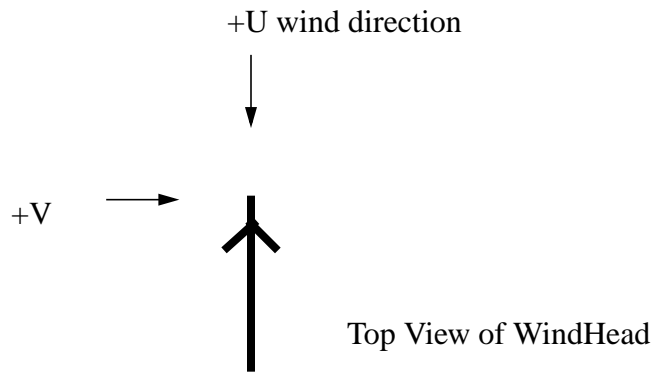
Signal	External 'Mast' Cable		Internal to CSAT Electronics box			
	Amp-9	CSAT	Bulkhead Cable	Serializer Adaptor 'Y' Cable	Serializer DE9(m)	CSAT sio DE9(m)
(Rx) Sonic to EVE	1 -----	B B	----(red)----	2 2	----(yel)----	2
(Tx) Eve to Sonic	2 -----	C C	----(wht)----	3 3	----(wht)-----	>3
(Gnd)	4 -----	E E	----(grn)----	5 5	----(grn)----	5
(RTS) to Sonic	3 -----	G G	----(brn)----	7 7	----(brn)-----	7
(CTS) to EVE	5 -----	H H	----(blk)----	8 8	----(blk)-----	8
Power +12	8 -----	D D	----(red)----	CSAT (1)	--(red)--	9
Power Gnd	7 -----	F F	----(blk)----	Pwr Conn. (2)		

Analog Wiring from Krypton Hygrometer to CSAT 'Analog' Connector

Signal	External 'Krypton' Cable		Internal to CSAT Electronics box	
	Amp-9	CSAT	Bulkhead Cable	Serializer Berg 10-Pin to A/D-J3
Krypton +	1 -----	C C	----(wht)---	3 AD Ch1+
Krypton -	2 -----	D D	----(grn)----	4 AD Ch1-
Shields	3 -----			
Channel 2 +	4 -----	E E	----(brn)----	5 AD Ch2+
Channel 2 -	5 -----	F F	----(blk)----	6 AD Ch2 -
Power +12	8 -----	A A	----(red)----	CSAT (1) --(red)--
Power Gnd	7 -----	B B	----(blk)----	Pwr Conn. (2)

6) UVW Directions:

The CSAT3 uses a right handed orthogonal coordinate system with the sensor head pointing in the negative '-x' direction (-U). Wind coming straight into the anemometer is from the +x (U) direction and wind coming from the 'left' of the anemometer is from the +y (V) direction, and wind coming from the ground upwards if from the +z (W) direction.



7) Maintenance / Performance Notes:

Rain: usually causes problems. The sonic properly stops working when a drop of water covers one of the 0.5 cm diameter transducers. With Version 4.0s software and the use of transducer wicks this situation is greatly improved.

Ice: adversely effects transducer performance. A layer 0.5mm thick can cause false triggering of the receiver at low temperatures especially when the true receive signal is smaller. If possible, the transducers should be kept clear of ice. NCAR has successfully used small Minco heaters attached to the transducers to remove ice. The heaters can be switched on/off dependent upon the drop/recovery of the sonic flag counts. Data taken with the heaters on are rejected.

Leveling: There are no electronic levels, only a bubble. Provided the installation is of sufficient duration and the level does not change, the level bias can be removed from the data using post-processing correction. The correction involves an assumption that the net verticle (W) component over time is zero. By averaging the verticle component over time, the bias is determined.

Scan Delay: A 2 scan delay exists between the output signals the the sampling time.

8) OLD/ Eve: Connection via PAM '10m Mast' Cable Wiring:.

TABLE 2. PAM/EVE Wiring

Signal	CSAT RS-232 DE-9 (Factory)	CSAT Connector	9-Pin Amp	Color	Comment
Received Data	2	B	1	white	To EVE/Aster
Transmit Data	3	C	2	black	From EVE/Aster
Ground	5	E	4	green	
RTS	7	G	3	black	From EVE/Aster
CTS	8	H	5	blue	
+12	Red (loose)	D	8	red	
Pwr Ground	Black (loose)	F	7	black	

OLD / EVE CONNECTION: The CSAT3 is interfaced to the EVE electronics via the front-panel connector labeled 'sonic.' Inside the EVE electronics box, install a PAM RS232-SIO jumper module on JP1 'Sonic Option Header.' or else install individual jumpers to allow the RS232 signals to be routed between the bulkhead and RJ45 connectors. (To enable CTS inside the EVE electronics jumper J1-1 to J3-4 and JP1-7 to JP1-8).

The CSAT can be routed to a 'EVE Serializer board' mounted either inside the EVE box, or installed inside the CSAT electronics box to allow the Krypton Hygrometer voltages to be directly 'synced' with the CSAT. Wiring for the Internal mounting is: