# 0.6 Gill R3 Sonic Anemometer
# Quick Reference

***Sections Include:***



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## 0.6.1 Description:

The Gill sonic anemometer consists of following pieces:

transducer head
Hirose to Amp 9-Pin connector: Mast cable (digital cable between R3 - EVE)
Power Interface / RS422 - RS232 unit (used during setup of the sensor)
Short adaptor cable for Mast cable to Power Interface unit (used during setup)

The following NCAR built pieces are required for mounting the sensor on the PAM mast:

sonic clamp
two piece mast clamp, and bolts
rectangular boom adapter
SBUS front panel RS485-RS232 converter board (mounted inside PAM box)

## 0.6.2 GILL R3 Setup:

The Gill R3 sonic must be configured in the lab using Gill's "RCOM" program, before the sensor is used on a PAM station. The following is the list of commands which should be sent to the sensor to set it up. The RCOM descriptions of these parameters are vary slightly from the actual commands shown. Note that newer versions of RCOM are menu driven and provide and automatic interface for the sensor (see below)

| | |
|---|---|
| AVERAGE 10 | Sets output to average 10 samples at 100Hz for 10Hz data. |
| WINDREP UVW CAL | Output data in UVW calibrated format |
| SOSREP SONICTEMP C | Output speed of sound as sonic temperature in degC |
| ABSTEMP OFF | No absolute temperature output |
| STRFMT BINARY | Output in binary format |
| MSGMODE CONT | Continuous (not polled) data output |

| | |
|---|---|
| BAUD 9600 | Current PAM configuration. |
| CTONE DISABLE | Turns off sonic beeping |
| ALIGNUVW AXIS | Sets UVW output to be aligned with transducer output rather than support spar. This is useful, when R3 and R2 sonics are being mixed in the field. Aligning UVW with the spar, seems like a more logical set of directions. |

### 0.6.3 GILL R3 UVW Directions:

View the R3 from above. An arrow points to “N”. Because the sonic axes are not aligned with N, N must have nothing to do with compass directions. One can infer that “N” means “Nice fetch”, because the spars are on the other side of the instrument.

When the data is output on axis alignment, then +U is 30deg counter-clockwise from “N”. +V is 120deg counter-clockwise from N. +W is up: a right hand coordinate system.

When the data is output on spar alignment, then +U is “N”, and +V is 90deg counter-clockwise.

### 0.6.4 Installation:

Mount The mast clamp, boom pieces and the sonic head. Normally the sonic points up into the air with the mast lying horizontally. Route the cabling through the mast to the desired opening in the mast.

There are electronic levels in the sonic head. These levels report data to EVE. When the mast is raised, level the mast using the leg levelers until both x and y axis are within 0.1 degrees. The levels have a +/- 30 degree range.

### 0.6.5 Gill / PAM Cabling:

The Gill R3 is interfaced to the EVE electronics via the front-panel connector labeled ‘sonic.’ Inside the electronics box, a PAM RS232-485 converter module must be installed on JP1 ‘Sonic Option Header.’ Note the PAM converter module is only capable of half-duplex operation whereas the Gill uses full-duplex. As a result, EVE can only receive serial messages from the sensor, but not transmit to the sensor.

*‘Mast Cable’ Wiring for EVE direct connection to the Gill:*

| Gill R3 / SIU Designation | Gill Sensor/Cable Hirose 20-pin Plug | PAM 9-Pin Amp Plug | Comment |
|---|---|---|---|
| RS422 Tx+ | 2 | 5 (RS485+) | 5/9 twisted shielded pair |
| RS422 Tx- | 3 | 9 (RS485-) | |
| RS422 Rx+ | 4 | 1 | N/C inside EVE |
| RS422 Rx- | 5 | 2 | N/C inside EVE |
| +12VDC | 6 | 8 | |
| Chassis | 9 | N/C | All shields tied together at Sonic end; N/C at EVE |
| Sync- | 10 | N/C | |
| Signal Ground | 13 | 4 | |
| Power Gnd | 14 | 7 | |

| | | |
|---|---|---|
| Sync+ | 18 | N/C |
| Not Used | 11,12 | |
| Reserved | 1,7,8,15,16, 17,19,20 | |

If a Gill Sensor Interface Unit (SIU) is placed between the R3 and PAM, for example to ingest additional analog channels and append those into a single message, the same cable as above can be used to connect the SIU to PAM. Obviously another cable is needed between the R3 and the SIU, which can be purchased from Gill.

The analog input wiring for the SIU is described in the R3 manual but for reference is:

| SIU A/D in | Description |
|---|---|
| 1 | Sensor Power - |
| 2 | Analog in 1+ (or for second connector 3+, third conn. 5+) |
| 3 | Analog ground |
| 4 | Analog in 1- (or for second connector 3-, third conn. 5-) |
| 5 | Analog in 2+ (or for second connector 4+, third conn. 6+) |
| 6 | Analog in 2- (or for second connector 4-, third conn. 6-) |
| 7 | Sensor Power + |
| 8 | Chassis / screen |

An example of this type implementation is the NCAR BandPass Hygrothermometer interface used in GAME-97B. The cabling for that is:

| SIU A/D in | BPH Amp 9-Pin | BPH Description |
|---|---|---|
| 1 | 7 | Power Ground |
| | 6 | Fan Gnd. |
| 2 | 1 | Temp.+ |
| 3 | open | |
| 4 | 2 | Gnd |
| 5 | 4 | RH+ |
| 6 | 5 | Gnd |
| 7 | 8 | Power + |
| | 9 | Fan Power |
| 8 | open | Chassis / screen |

The Gill Manual mentions a limitation of 70mA total power available for the analog sensors at a voltage of 1.5 less than the input to the SIU itself. There is no internal protection for this output circuit but the realistic limit according to Gill is probably 100mA. If more than this or a load which consistently operates at this level is installed, an in-line fuse to protect the SIU should be considered.

### 0.6.6 GILL RCOM Cabling:

The Gill RCOM software runs on a PC under DOS. RCOM allows and operator to program operating parameters and/or collect, plot and archive data from the sensor. The Gill Power Interface / RS422-RS232 box is needed to do this. The box is powered by A/C wall plug. The sensor is connected to the interface box via a short jumper cable between it and the PAM 'mast cable' which has the 20-pin Hirose connector described above. The jumper cable has a 15-pin plug going into the box and a recepticle to plug the mast cable into after removing it from the EVE electronics box. Note these 2 cables leave the sonic sync signals disconnected from the interface box.

*Wiring of the short 15-pin to 9-pin Amp splice cable*

| Gill R3 Designation | Gill Sensor/Cable Hirose 20-pinreference | DA-15 Amp Recepticle | PAM 9-Pin |
|---|---|---|---|
| Shield | | 1 | N/C |
| RS422 Tx+ | 2 | 2 | 5 (RS485+) |
| RS422 Tx- | 3 | 9 | 9 (RS485-) |
| RS422 Rx+ | 4 | 3 | 1 |
| RS422 Rx- | 5 | 10 | 2 |
| +12VDC | 6 | 5 | 8 |
| Chassis | 9 | | |
| Sync- | 10 | 8 | N/C |
| Signal Ground | 13 | 4 | 4 |
| Power Gnd | 14 | 11 | 7 |
| Sync+ | 18 | 6 | N/C |
| Not Used | 11,12 | 7,14 | |
| Reserved | 1,7,8,15,16,17,19,20 | 12,13,15 | |

### 0.6.7 Gill Connector Part Numbers:

PAM interfaces with the Gill R3 require custom cables. The Hirose connectors used by Gill are available from them by ordering their part numbers:

| | | |
|---|---|---|
| 8-Pin analog input | 020-00921 | $50 |
| 10-Pin Interface | 020-00290 | $50 |
| 20-Pin Interface | 020-01559 | $50 |

### 0.6.8 EVE Configuration Commands:

EVE configuration commands needed to ingest the Gill data are shown below. These assume that the Note that the 'CREATE WIND.SPD' commands are normally not used by NCAR, but provide scalar speed and direction values if they are desired. See the EVE manual for more information on how to setup the serial port and to perform covariances, despiking and OUTPUT archives of the data.

```
################### GILL SONIC
# Ingest GILL R3-3D  "Research" sonic
# Binary input, no extra analog values (ie no SIU attached)
SIO: /tyCo/2 9600 none 8 rs485
BINSERIAL: SONIC /tyCo/2
BA BA
```

```
statAdr byte big signed 1 0
statVal byte big signed 1 0
Uraw short big signed 0.01 0
Vraw short big signed 0.01 0
Wraw short big signed 0.01 0
# Changed from "unsigned" to "signed" for Tsonic_raw
# of GILL sonic to adjust the environment
# Tsonicraw short big unsigned 0.01 0
Tsonicraw short big signed 0.01 0
csum byte big unsigned 1 0
:

# Flush out big spikes/glitches
CREATE: U=minCheck SONIC.Uraw -100
CREATE: V=minCheck SONIC.Vraw -100
CREATE: W=minCheck SONIC.Wraw -100
CREATE: Tsonic=minCheck SONIC.Tsonicraw -100

# Extract Levels
CREATE: tempx1 xlev=xlevel SONIC.statAdr SONIC.statVal
CREATE: tempy1 ylev=ylevel SONIC.statAdr SONIC.statVal

DO: AVG SONIC.xlev
DO: AVG SONIC.ylev

# NOT NORMALLY USED BY NCAR, but in order to
# Create sonic scalar wind speed add this.
# Note, do this here, not necessary to sync it for covaring, just need averaging.
#
CREATE: X=multiply SONIC.Uraw SONIC.Uraw
CREATE: Y=multiply SONIC.Vraw SONIC.Vraw
CREATE: Z=add SONIC.X SONIC.Y
CREATE: WS=sqrt SONIC.Z

# NOT NORMALLY USED BY NCAR, but in order to
# generate scalar WD for a Gill-R3,
# with north (0-degrees) wind coming from the direction of the +U axis
# of the R3 and toward the -U axis.
# Note, you must adjust these offsets if you want to align north
# differently, such as along the 'N' arrow of the Gill which is 30-degrees
# CW from +U.
# This will not work for a Gill-R2, because it has the a left hand,
# opposite coordinate system.
# Note, do this here, not necessary to sync it for covaring, just need averaging.
#
# First test V to prevent divide by zero, and substitute
# a very small number if that would happen.
CREATE: TMP=ifEQscale SONIC.Vraw SONIC.Vraw 0 0 .00001
CREATE: R=divide SONIC.Uraw SONIC.TMP
```

```
CREATE: S=atan SONIC.R
CREATE: TMP=multiplyC SONIC.S 57.2957795
CREATE: TMP=ifLTscale SONIC.Vraw SONIC.TMP 0 1 180
CREATE: WD=addC SONIC.TMP 90
CREATE: WD=dirOffset WIND.WD 'value'                Use this for an offset

# SECONDARY PROCESSING: Despiking, Sync10, Covars, Flags NOT SHOWN
```

### 0.6.9 Maintenance / Performance Note:

Transducer performance is adversely effected by icing. A layer of ice 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.

In NCAR's use, The Solent is extremely reliable, but somewhat less accurate than the ATI or CSAT. The Solent almost always works in the rain, the ATI works in some rain, and the CSAT rarely works in the rain. The ATI and CSAT stop working properly when a drop of water covers a transducer. This occurs more easily with the CSAT because the transducers are 0.5 cm in diameter, while the ATI's are 1 cm in diameter.