User Manual

3 Axis Ultrasonic Anemometers

1210-PK-085 (R3-50)

1210-PK-065 (R3-100)

1210-PK-066 (R3A-100)

Document Number: 1210-PS-0015 Issue 3

R3-50™   R3-100™   R3A-100

Table of Contents

1. Welcome to the R3 user manual

1.1. About this manual

This manual describes the operation of the R3-50 (1210-PK-085), R3-100 (1210-PK-065) and R3A-100 (1210-PK-066).

The term R3 is used in this manual as a general term for the R3-50, R3-100 and R3A-100; they are robust three axis anemometers with no moving parts.

The units of wind speed, output rate and formats are all user selectable.

The R3-50, R3-100 and R3A-100 are constructed of aluminium & carbon fibre & can perform measurements in wind speeds up to 45m/s.

The R3-50 can provide an output rate up to 50Hz and the R3-100/R3A-100 can provide an output rate up to 100Hz.

The below software is available free from the Gill website https://gillinstruments.com/downloads/

WIND software. It can be used as a terminal package to configure the anemometers

WINDVIEW software. It provides a means of viewing data and performs a simple data logging function.

WinConvert software. It provides a means of converting data gathered in binary format to a user readable format.

1.2. Overview of Content

The manual is split into 7 chapters. Each chapter represents an activity in the use of the product. Additional detailed information is contained in the Appendices at the end of the manual.

- Chapter 1 explains how the manual is set out
- Chapter 2 provides the information needed to install the product
- Chapter 3 provides the information needed to operate the product
- Chapter 4 provides the information needed to connect to the product
- Chapter 5 provides the information needed to use the Serial Outputs
- Chapter 6 provides the information needed to use the Analogue Inputs with Sensor Input Unit
- Chapter 7 provides the information needed to use the Analogue Outputs with PCIA box 1189-PK-030

1.3. Description of Icons

The following icons are used in this manual.

Icon	Description
⚠️	A note that is important and that should be observed
ℹ️	Information or a recommendation to ensure best results
▶️	The start of a set of instructions

1.4. General Notes

⚠️ Before R3 is used for the first time it is essential to read and understand this manual. Please keep the manual safe for future reference.

⚠️ Care should be taken with R3 at all times. The product should be transported to site in the box, and only removed when ready to install.

⚠️ During installation R3 should be supported and care should be taken not to drop the product

⚠️ Care should be taken when wiring the R3 to power and communications.

⚠️ Maintenance should be limited to the procedures described in this manual. Additional maintenance or cleaning may damage the sensors.

⚠️ No attempt should be made to open or repair any of the parts of the product. Any attempt to dismantle any part of the product will invalidate the warranty provided by Gill Instruments.

1.5. CE, UKCA, FCC conformity

This product carries the CE and UKCA marks. A copy of the Declaration of Conformity can be downloaded from gillinstrurments.com.

HS complies with part 15 of the RCC Rules. Operation is subject to the following two conditions: -

1. This device may not cause harmful interference, and
2. This device must accept any interference received, including interference that may cause undesired operation

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense. See Section 2.1 for more details.

1.6. User Manual Revision History

Document Version	Release Date	Key Changes
Issue 3	June 2024	Update to latest format, and part-number changes.

1.6. User Manual Revision History

2. Installation

2.1. Installation Guidelines

As with any sophisticated electronics, good engineering practice should be followed to ensure correct operation.

➢ Always check the installation to ensure the R3 Range is not affected by other equipment operating locally, which may not conform to current standards, e.g. radio/radar transmitters, boat engines, generators etc.

➢ Guidelines –
   • Avoid mounting in the plane of any radar scanner – a vertical separation of at least 2m should be achieved.
   • Radio transmitting antennas, the following minimum separations (all round) are suggested.

      ❖ VHF IMM – 1m
      ❖ MF/HF – 5m
      ❖ Satcom – 5m (avoid likely lines of sight)

➢ Use cables recommended by Gill. If cables are cut and re-connected incorrectly (perhaps in a junction box) then EMC performance may be compromised if cable screen integrity is not maintained.

➢ Earth loops should not be created – wire the system in accordance with the installation guidelines.

➢ Ensure the power supply operates to the R3 specification at all times.

➢ Avoid turbulence caused by surrounding structures that will affect the accuracy of the R3 such as trees, masts and buildings.

➢ The World Meteorological Organisation makes the following recommendation:

➢ The standard exposure of wind instruments over level open terrain is 10m above the ground. Open terrain is defined as an area where the distance between the sensor and any obstruction is at least 10 times the height of the obstruction.

➢ If the sensor is to be mounted on a mast boom, part way up a tower or mast, then the boom should be at least twice as long as the minimum diameter or diagonal of the tower. The boom should be positioned on the prevailing wind side of the tower.

➢ If mounted on a pole then as a guide the distance from an adjacent pole should be 10 times the other pole diameter.

➢ If mounting on a building then as a guide the sensor should be mounted at a height of 1.5 times the height of the building.

Immunity test requirements for equipment intended to be used in an industrial electromagnetic environment have been applied. These test levels are above the levels expected to be experienced in normal use due to the above recommended siting conditions, but disturbances may be expected 150 to 200kHz. If any interruption to performance is experienced due to external electromagnetic signals the product will automatically return to specification once the signals levels have diminished.

2.2. Alignment

The anemometer has slotted fixing holes permitting ±5° rotation for alignment.

Figure 1 and Figure 2 and how the direction and polarity of the U, V and W axis.

2.3. Polar definition

The wind speed in the UV plane, with direction in degrees from 0 to 359°, with respect to the Reference spar (which is normally aligned to North).

2.4. U, V, and W axes definition

+U is defined as towards the direction in line with the north spar as indicated in Figure 1 and Figure 2.

+V is defined as towards the direction of 90° anti-clockwise from N / the Reference spar.

+W is defined as vertically up the mounting shaft.

⚠️

When the unit is configured for the **ALIGN AXIS** setting the UV definition rotates 30 degrees anti-clockwise such that U is now in line with transducer axis 1.
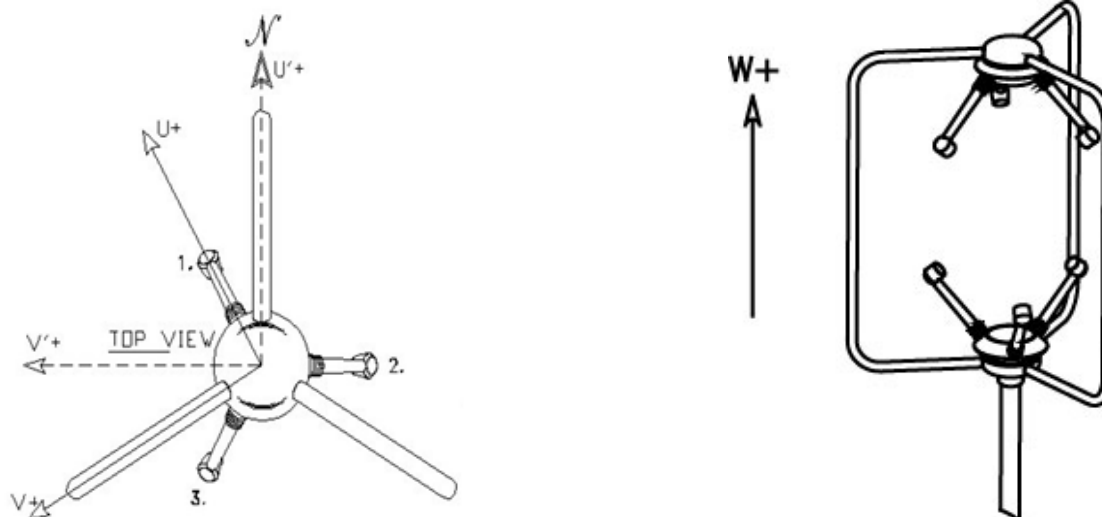
Figure 1 R3-50 and R3-100 U, V and W Axis Definition
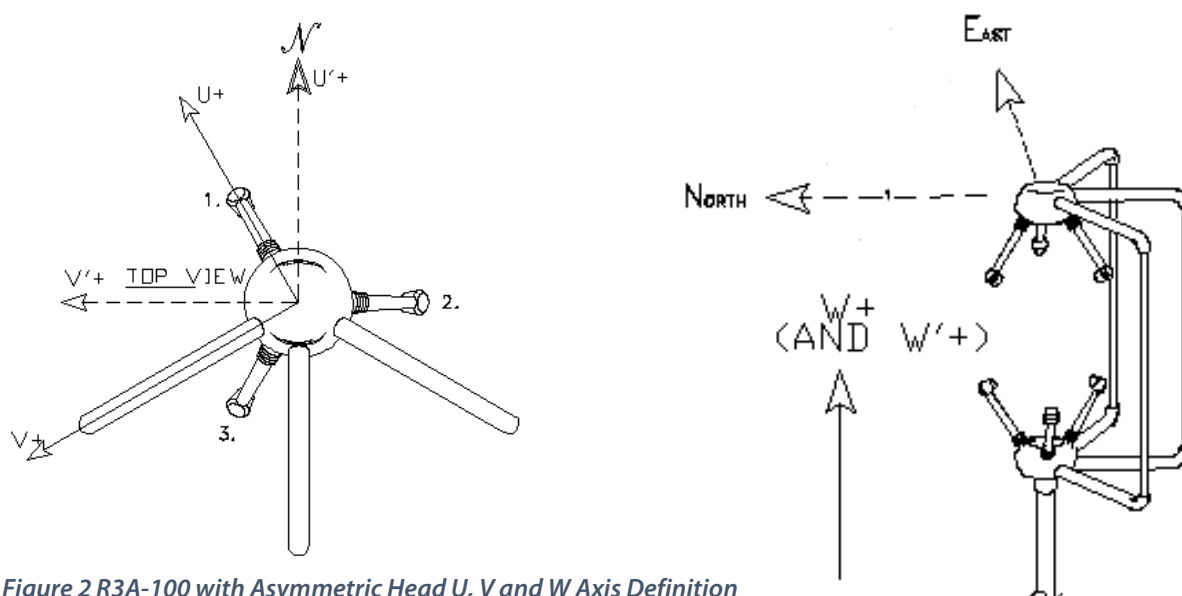
Figure 2 R3A-100 with Asymmetric Head U, V and W Axis Definition

2.5. Orientation

Normally the R3 is mounted vertically, ensuring a horizontal Measuring Plane.

However, the unit may be mounted with the Measurement Plane set to any required orientation, **provided** the sealing gasket is fitted to the flange and provision is made to seal the M6 base mounting nuts (i.e. with a rubber boot) to prevent water ingress. **Attention to sealing is especially important if the unit is to be used in an inverted position** and it is advised to also use RTV sealant around the base when unit is connected up so as to prevent water penetration through cables/connectors or base screws etc.

2.6. Alignment and Dimensions

The reference north spar is indicated by a notch (that is in the direction line with north), which is also indicated on the base of the unit by another notch.
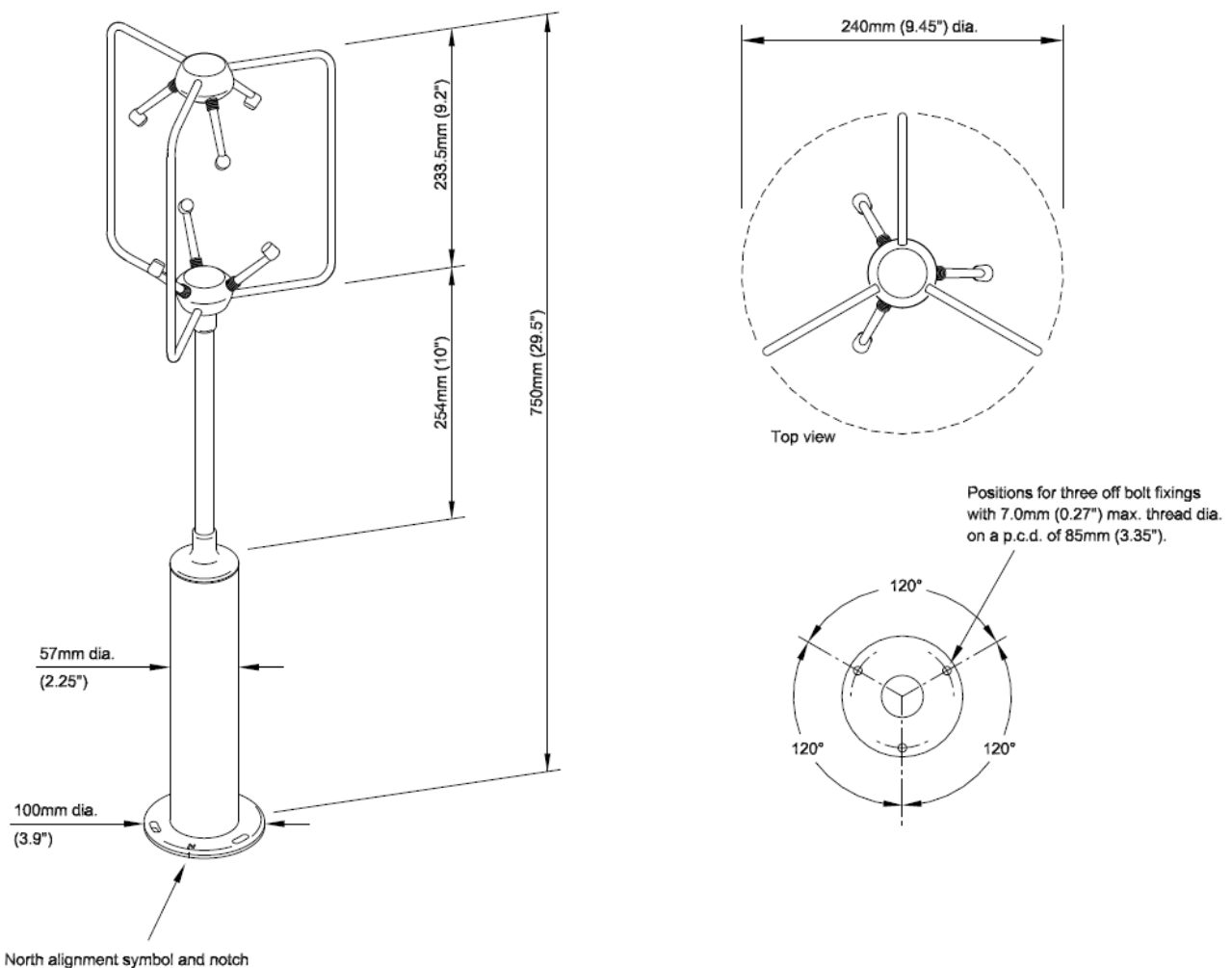
Figure 3 R3-50 and R3-100 North Spar Alignment and Dimension

240mm (9.45") dia.

Top view

Positions for three off bolt fixings
with 7.0mm (0.27") max. thread dia.
on a p.c.d. of 85mm (3.35").

120°
120°
120°
120°

233.5mm (9.2")
254mm (10")
750mm (29.5")

57mm dia. (2.25")

North alignment symbol
and notch

100mm dia. (3.9")
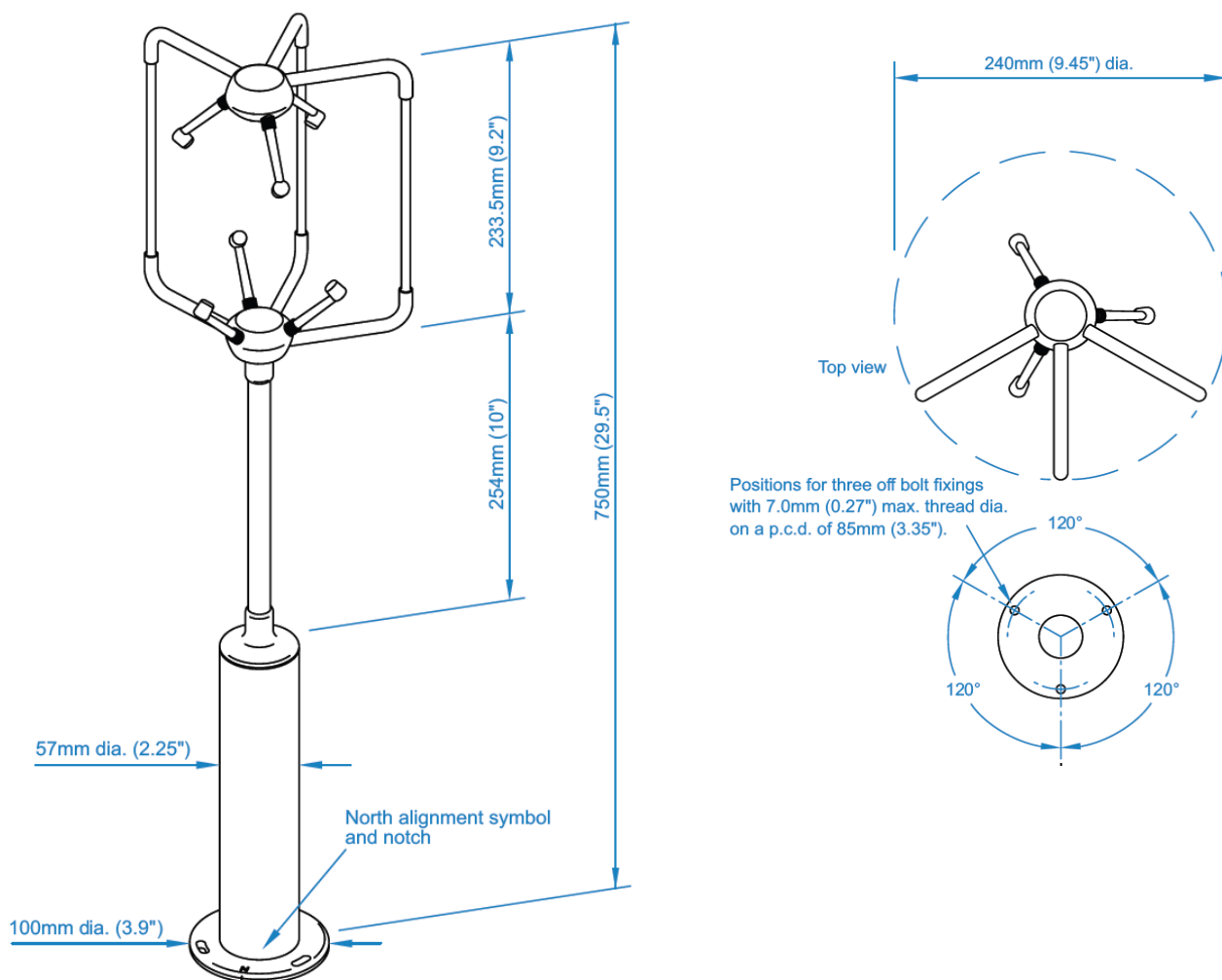
Figure 4 R3A-100 North Spar Alignment and Dimensions

2.7. Bench Test

Before installing, it is strongly recommended that a bench test is carried out – see Appendix I - Tests.

2.8. Location

Select a position so that the unit is clear of any structure, which may obstruct the airflow or induce turbulence.
Do NOT mount the R3 in close proximity of high-powered radar or radio transmitters. A site survey may be required if there is any doubt about the strength of external electrical noise.

2.9. Corrosion

The anemometer mounting base is anodised aluminium alloy and careful note should be taken of the possibility of galvanic corrosion by incorrect mounting. It is vital that only stainless steel fixings are used and that the instrument is insulated from the metal of the mounting surface with the rubber gasket. This will ensure that the anemometer will provide long service under extreme conditions e.g. marine.

2.10. Earthing

For maximum protection against lightning the anemometer must be earthed via its mountings. The SIU and PCIA should be earthed using the earth studs provided.

To ensure correct operation, and for maximum protection against lightning, the anemometer **MUST** be correctly grounded (earthed) via its mountings. Inadequate grounding will degrade anemometer performance, particularly in the presence of radio frequency interference.
The unit **MUST** be connected to an appropriate grounding point with a minimum of 6mm² copper wire, via the M4 base screws. The primary earth for the anemometer must be provided via the base screws and not via the cable screens.

2.11. Mounting Base
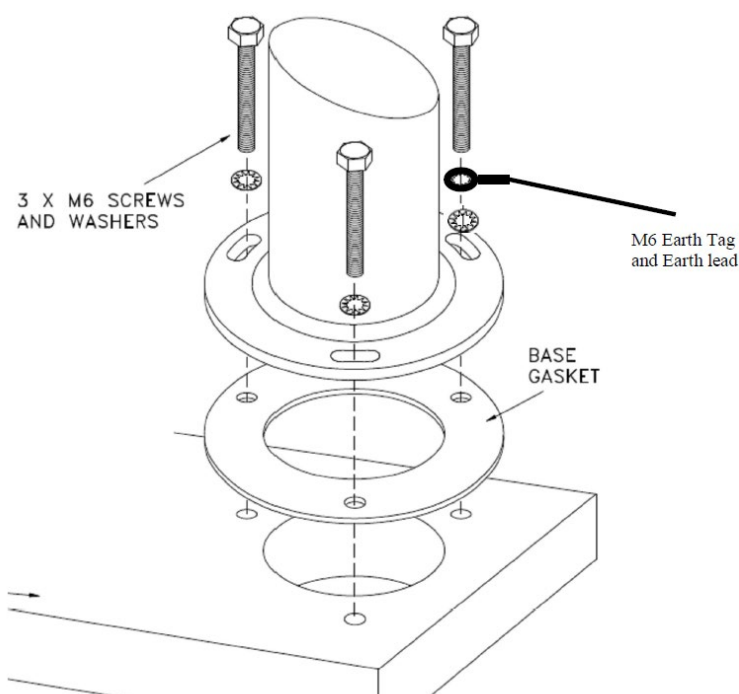
Figure 5 Mounting Base

2.12.   Flange Mounting

Mount the unit to a suitable surface, using the flange gasket and the M6 nuts, bolts and washers provided, ensuring that the clearance for the connector is maintained as shown in **Figure** 6.
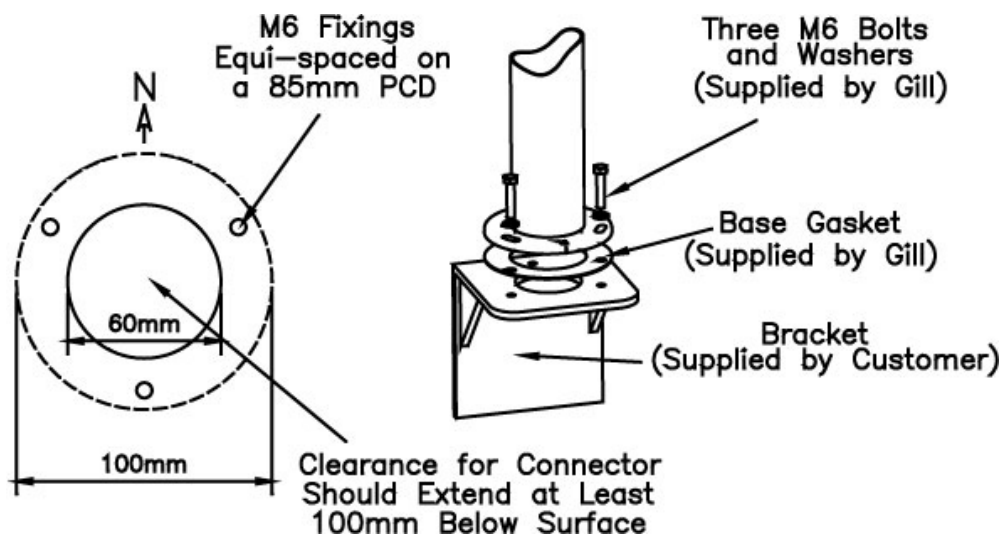
Figure 6 Flange Mounting

2.13.   Cabling

Ensure that strain relief measures are employed when installing the cables. Do not allow the whole weight of a cable to be applied to the connector.

An RS422 compatible cable should be used, with the number of twisted pairs matching the application.

Generic description – Twisted pairs with drain wire, screened with aluminised tape, with an overall PVC sheath. Typical Wire size 7/0.2mm (24AWG), 22AWG wire may also be used.

The table shows some suitable manufacturers' references; other manufacturers' equivalents can be used.

No. of pairs	Gill ref.	Belden ref.	Batt electronics ref.
9	026 - 02663	8774	91009

The cable allows for the connection of all: -
Power inputs.
Digital data inputs and outputs.

Other example twisted pair screened cable types (24AWG) are:-

No. of pairs	Gill ref.	Belden ref.	Batt electronics ref.
2	-	9729	-
3	026 - 02660	9730	91030
4	026-03156	9728	91199
6	-	9731	91031

2.14.   Cabling Length

Communication format	Baud rate	Max. cable length
RS232 (PCIA Output)	9600	6.5 m (20 ft) or if using Cat 5 cable see manufacturers recommendations
RS422	9600	1 km (3200 ft)
Analogue outputs - voltage	N/A	6.5 m (20 ft)

The maximum cable length is dependent on the chosen communication format (RS232, RS422 or RS485), the baud rate, and, to a lesser extent, on the cable type and the local electrical 'noise' level.

The above table shows the typical maximum lengths at the given baud rates, using the recommended cable. If any problems of data corruption etc. are experienced, then a slower baud rate should be used. Alternatively, a thicker or higher specification cable can be tried.

3. Operation

3.1. Overview

- Data output rates up to 100Hz (model dependant).
- Measurement of wind velocities to 45ms.
- Wind speed accuracy <1% RMSE.
- Configuration carried out via serial port and stored in non-volatile memory.
- High speed, full duplex RS422 interface, operating up to 115200 baud.
- Background diagnostics providing the user with the confidence that the unit is operating correctly.
- Optional Sensor Input Unit providing six differential 14 bit analogue inputs and one PRT100 input.
- Optional Power & Communications Interface with 4 Analogue outputs representing wind speed and Speed of Sound, or Sonic Temperature.

3.2. Operating Modes

The anemometer has two operating modes:
1.   Measurement mode - This is the normal mode of operation, which is the default mode from power up.
2.   Interactive mode - This allows the anemometer to be configured and interrogated.

3.3. Measurement Mode

The principle of operation is described in Appendix K. The parameters sampled are determined by the anemometer's configuration and consist of:
1.   Wind velocity (axis velocities are always sampled)
2.   Speed of Sound (SoS)
3.   Analogue Inputs (6)
4.   Absolute Temperature (PRT100)

The way in which the results are calculated, formatted and reported depends upon the configuration of the anemometer.

3.4. Sampling

Wind velocity, SoS and analogue inputs are sampled every 10ms, in a fixed sequential pattern. The PRT100 is sampled every 40ms. The measurement sequence is shown in Figure 14 on page 31.

3.5. Averaging (and Output Rate)

These samples are block averaged before being converted into results. For wind speed, Speed of Sound and analogue inputs the number of samples used in the block average can be set to between 1 and 250 (R3-100, R3A-100) or 2 and 250 samples (R3-50).

Output rate frequency is calculated from 100/Average setting.

E.g. Default Average Setting is 5 therefore Output Rate = 100/5 = 20Hz.

The corresponding maximum number of PRT100 samples per result is 62.

3.6. Wind Measurement, SoS and Temperature Reporting Format

The wind measurement can be output in one of the following formats:

1.   U, V & W, calibrated (ms)
2.   U, V & W, uncalibrated (ms)
3.   Polar & W, calibrated (° & ms)
4.   Polar & W, uncalibrated (° & ms)
5.   Axis velocities, uncalibrated (ms)

In U, V,W modes the alignment of the U and V axes can be selected as follows:-

Axis U in line with Axis 1 when the anemometer is viewed from above.

Spar U is in line with the main spar when viewed from above. In this configuration U, V, W are labelled U', V', W'.

The U, V, W axis alignment options are shown in Figure 1 and Figure 2 on page 8.

The axis alignment can be selected using the Configuration menu and the ALIGNUVW command if using your own PC software.

The speed of sound measurement results can be output in one of the following formats:
1.   Speed of Sound (ms)
2.   Sonic Temperature (K)
3.   Sonic Temperature (°C)
Speed of sound measurements can be disabled.

The absolute temperature measurement results can be output in one of the following formats:
1.   Absolute Temperature (K)
2.   Absolute Temperature (°C)
Absolute temperature measurements can be disabled.

3.7. Analogue Input Reporting Formats
If ASCII format is selected, analogue input measurements are output in volts to 4 decimal places. If binary format is selected, analogue input measurements are output in 2's complement.
The number of analogue inputs to be measured can be set from 0 to 6.

3.8. Diagnostics
The system reports error codes if a failure is detected of the ultrasonic transducers, non-volatile memory or PRT.

3.9. Confidence Tone
This function is enabled by default, normal instrument operation is indicated by a repetitive audible tone from within the anemometer.

To turn off the Confidence Tone place the unit into Interactive Mode and use the command CTONE DISABLE.

3.10.   Result Reporting
The selected parameters are blocked together along with the diagnostic results and block control information to form a result message. The result message can either be in a Binary or ASCII format. In the ASCII format the fields can be padded to form a fixed field size if required. The way the result message is transmitted is dependent on the reporting mode:
1.   Continuous mode - the result message is transmitted immediately after calculation.
2.   Polled mode - the host pc requests data from the anemometer. The anemometer responds by sending the current result message.

3.11.   Interactive Mode
Interactive mode is entered from measurement mode, by sending the anemometer the IM command (see Para 14.2). In this mode the user can communicate with the anemometer, issuing configuration commands to the anemometer, or requesting information from the anemometer.

3.12. Configuration Commands

Configuration commands (see Appendix D) allow the user to configure the anemometer as required. The configuration parameters are held in non-volatile storage, allowing the anemometer to retain its current configuration when powered down.

3.13. Interrogation Commands

Interrogation commands allow the user to request various information from the anemometer.

E.g.   ?, CONFIG, EXIT, HELP, IM, SN, VER and VERIFY.

See Appendix D.

4. Connection

4.1. Connecting to PC or other device

Connection to a PC or other device requires the use of:
1.   Either a standard PCI or PCIA
2.   Or a suitable alternative power supply and RS422 conversion unit, which meets the specification of the anemometer.

The PCIA supplies power for the anemometer and provides conversion of the RS422 signal sent by the anemometer and the RS232 signal required by a PC. The PCIA requires connection to a mains power supply or DC.

The anemometer outputs data in RS422 format, which can be reconstituted to analogue via the optional PCIA.

Baud rate options are:
1.   2400
2.   4800
3.   9600
4.   19200
5.   38400
6.   57600
7.   115200

⚠️

If changing a unit to 115200 Baud rate ensure that the connecting device supports 115200 baud e.g. RS422 converter, PC/Laptop etc.).

Data format:
8 data, 1 stop, no parity.

4.2. Anemometer Connector / SIU Power and Data Connector

Hirose 20-way socket

Connector pin	Designation
1	Reserved
2	RS422TXB (Data from anemometer)
3	RS422TXA (Data from anemometer)
4	RS422RXB (Data to anemometer)
5	RS422RXA (Data to anemometer)
6	Supply V+
7	Reserved
8	Reserved
9	Chassis
10	Anemometer Sync-
11	Not used
12	Not used
13	Digital 0V, signal ground
14	Supply V-
15	Reserved
16	Reserved
17	Reserved
18	Anemometer Sync +
19	Reserved
20	Reserved

The above voltages are referenced to signal ground.

4.3. Connection R3 To A PC Using RS422

R3 Connector			PC with RS422 to RS232/USB convertor
Signal Names	**20 way Pin No's**		**Signal Name**
RS422 Tx+	2		RS422 Rx+
RS422 Tx-	3		RS422 Rx-
RS422 Rx+	4		RS422 Tx+
RS422 Rx-	5		RS422 Tx-
Digital 0v	13		Signal Gnd
Supply V+	6		+ DC Supply (9-30v)
Supply V-	14		- DC Supply (0v)

4.3. Connection R3 To A PC Using RS422
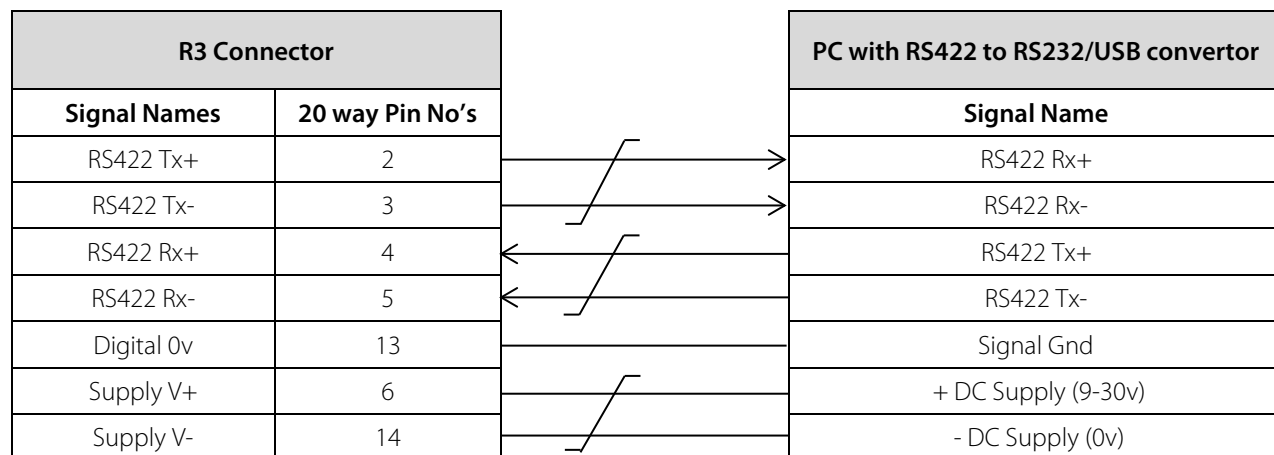
4.4. Connecting R3 to a PC via Optional Power and Communications Interface (PCI 1189-PK-031 or PCIA 1189-PK-030)

Dependent upon system requirements the R3 unit can be operated with the Power and Communications and Interface unit (PCI) or Analogue Output version (PCIA), which can be ordered as an optional extra. Connect R3 via RS422 port; then connect computer to RS232 port on PCI/PCIA.

R3 20 Way Connector			PCI 15 Way D Type Connector		PCI RS232 9 Way D Type Connector			Computer 9 Way D Type Connector	
Signal Names	Pin No's		Pin No's	Signal Name	Signal Name	Pin No's		Pin No's	Signal Name
TX (+)	2		2	RXB (+)					
TX(−)	3		9	RXA (−)	DCD	1			
					TX	2		2	RX
RX (+)	4		3	TXB (+)					
RX (−)	5		10	TXA(−)					
					RX	3		3	TX
					DTR	4			
					GND	5		5	GND
					DSR	6			
Digital 0v	13		4	DIGITAL 0V	RTS	7			
					CTS	8			
					RI	9			
POWER V+	6		5	POWER V+					
POWER 0V	14		11	POWER 0V					
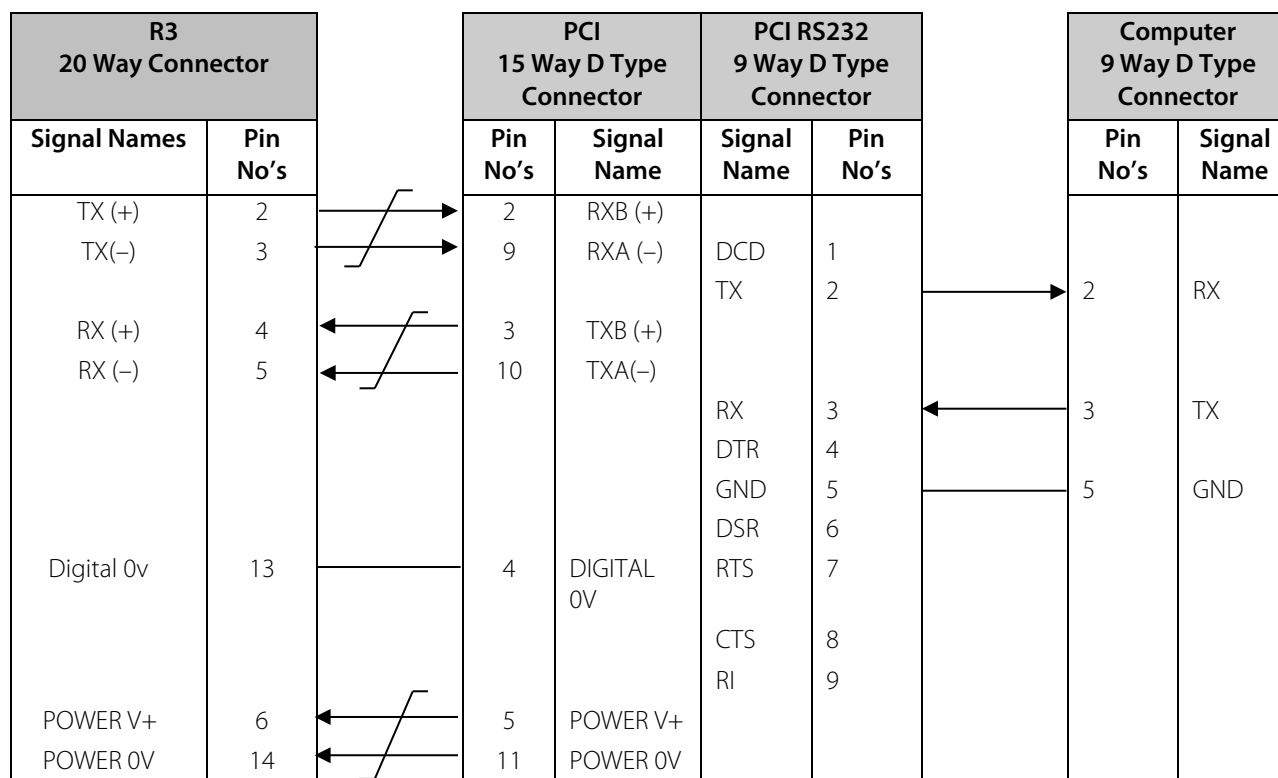
4.5. Environmental

The Desktop PCI/PCIA is intended for use in a protected environment and provides interfacing to a single anemometer. RS232 and RS422 ports are provided. The PCI/PCIA is not intended for outdoor use.

4.6. PCI/PCIA Electrical Power Requirements

The Unit must be powered via the PCIA, which itself must be powered using the supplied AC-24VDC convertor. EMC compliance cannot be ensured using any other configuration.

4.7. PCI/PCIA Operation

There are three Red LED's on the PCI/PCIA front panel.

When the PCI/PCIA box is powered the Power LED will illuminate.

When a R3 is connected as above to the PCI/PCIA box and is set to output continuous data the box RX LED will flash on/off at the R3 output rate thus giving a good indication that the R3 output is wired to the correctly and outputting RS422 data correctly.

If the PCI/PCIA RS 232 connection is connected to a computer then when a terminal programme is opened and commands sent by a PC keypad or program to the box its TX LED will illuminate intermittently indicating a good connection between the PC and the box. Connector Pin and Cable Assignments for PCI/PCIA are as follows:-.

Anemometer Connector 15 – Way	
Pin	**Designation**
1	Screen
2	RS422_RXB (+)
3	RS422_TXB (+)
4	Digital 0V, Signal ground
5	Supply V+
6	Anemometer Sync +
7	Not used
8	Anemometer Sync -
9	RS422_RXA (-)
10	RS422_TXA (-)
11	Supply V-
12	Not Used
13	Not Used
14	Not used
15	Not Used

RS232 Output - 9 way	
Pin	**Designation**
1	DCD
2	TX data
3	RX data
4	DTR
5	Signal Ground
6	DSR
7	RTS
8	CTS
9	RI

External, DC Supply 4 - Way	
Pin	**Designation**
1	Interface Box V+
2	Interface Box V-
3	Anemometer Only V-
4	Anemometer Only V+

RS422/Network Input 9 Way	
Pin	**Designation**
1	Not connected
2	Not connected
3	Not connected
4	RS422_RXA (-)
5	Signal ground
6	RS422_TXA (-)
7	RS422_TXB (+)
8	RS422_RXB (+)
9	Earth

Sync/Auxiliary Output 9 Way	
Pin	**Designation**
1	Not Used
2	Not Used
3	Not Used
4	Not Used
5	Not Used
6	Anemometer Sync +
7	Anemometer Sync -
8	Not Used
9	Not Used
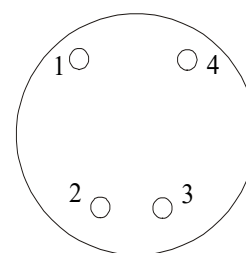
Figure 7 External DC Supply Amphenol C91A Screw Lock 4-Way Socket, e.g. T3301 001 – view looking at pins

4.8. PCI Box (1189-PK-030) R3 Analogue Output Connections.

Note: The PCIA box can convert the digital output from the R3 to analogue outputs.

Function	PCIA Box 25 Way D Type Connector
1	Analogue Ground 1
2	Analogue Ground 2
3	Analogue Ground 3
4	Analogue Ground 4
5	Analogue Ground 5
6	Analogue Ground 6
7	Analogue Ground 7
8	Analogue Ground 8
9	Test Pin 1
10	Signal Ground
11	Earth
12	Signal Ground
13	Signal Ground
14	Analogue Output 1
15	Analogue Output 2
16	Analogue Output 3
17	Analogue Output 4
18	Analogue Output 5
19	Analogue Output 6
20	Analogue Output 7
21	Analogue Output 8
22	Test Pin 2
23	Earth
24	Status Output
25	Sync Output

The **analogue outputs** have the following specification:
Full scale range: -2.5v to +2.5v
Accuracy: 0.25% of full scale (9 bits)
Resolution: 14 bits over ±3.0v
Settling time: 2ms to 0.25% accuracy (note that the minimum time between
Samples is 10ms)
Output resistance: <0.5Ω at frequencies below 100Hz, short circuit proof
Load resistance: Greater than 10kΩ
Load capacitance: Between 0 and 1000pF (e.g. up to 10m of coaxial cable)

Test 1, Test 2 Inputs
Logic high (inactive) +3V to +5V or open circuit
Logic low (active) <1V
The above voltages are referenced to signal ground.

Analogue Sync and Status Outputs
Both Sync and status outputs conform to the following electrical specification:
Output Voltages: high +3V to +5V
(Referred to signal ground) low <1V
Output resistance: <100Ω, short circuit proof
Load resistance: Greater than 10kΩ
Load capacitance: Between 0 and 1000pF (e.g. 10m of coax)
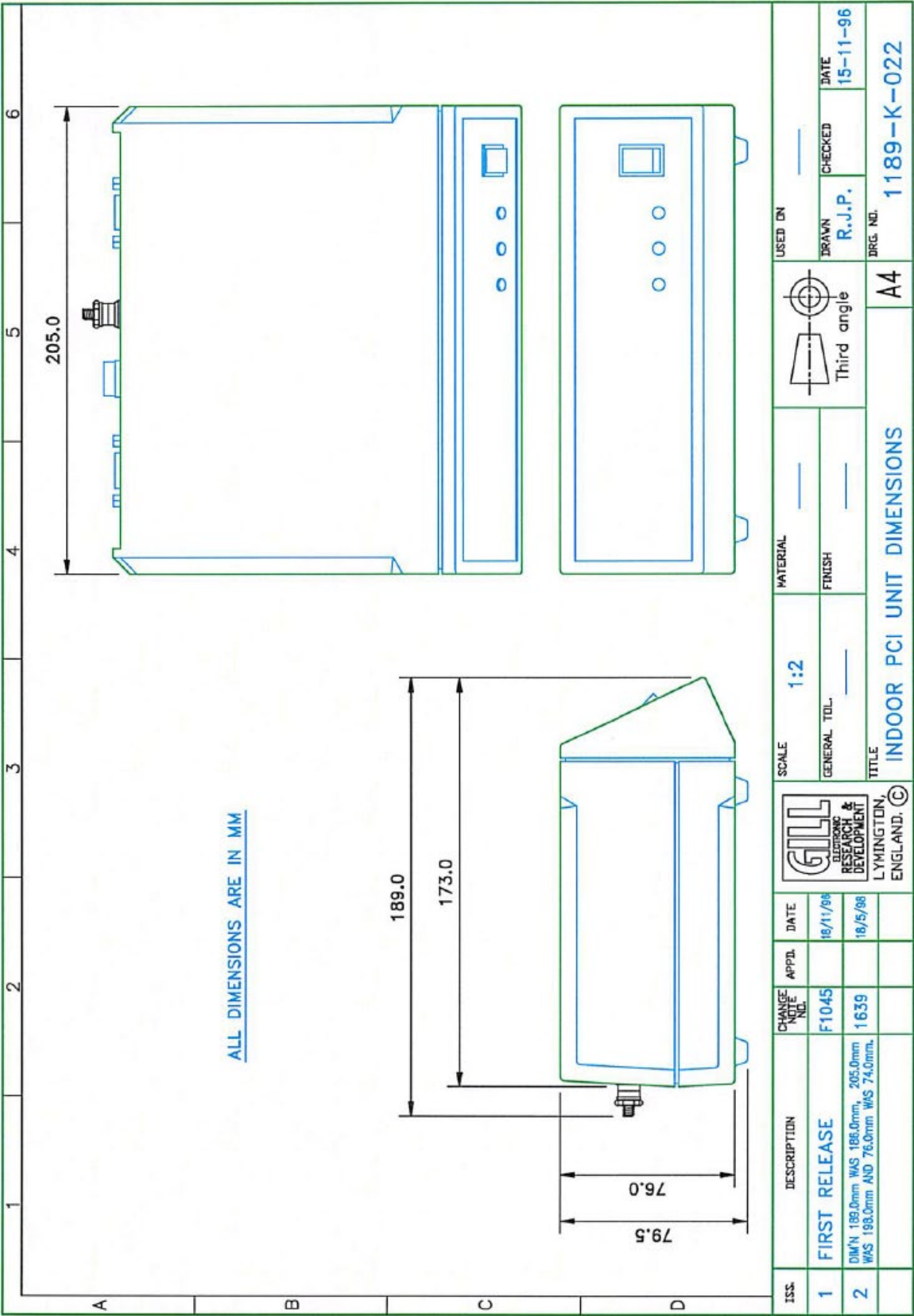
Figure 9 Indoor PCI Unit Dimensions

4.9. System Connection Diagrams

This section deals with connecting the R3 to other devices.

4.9.1. Connecting R3 to a PC using RS422
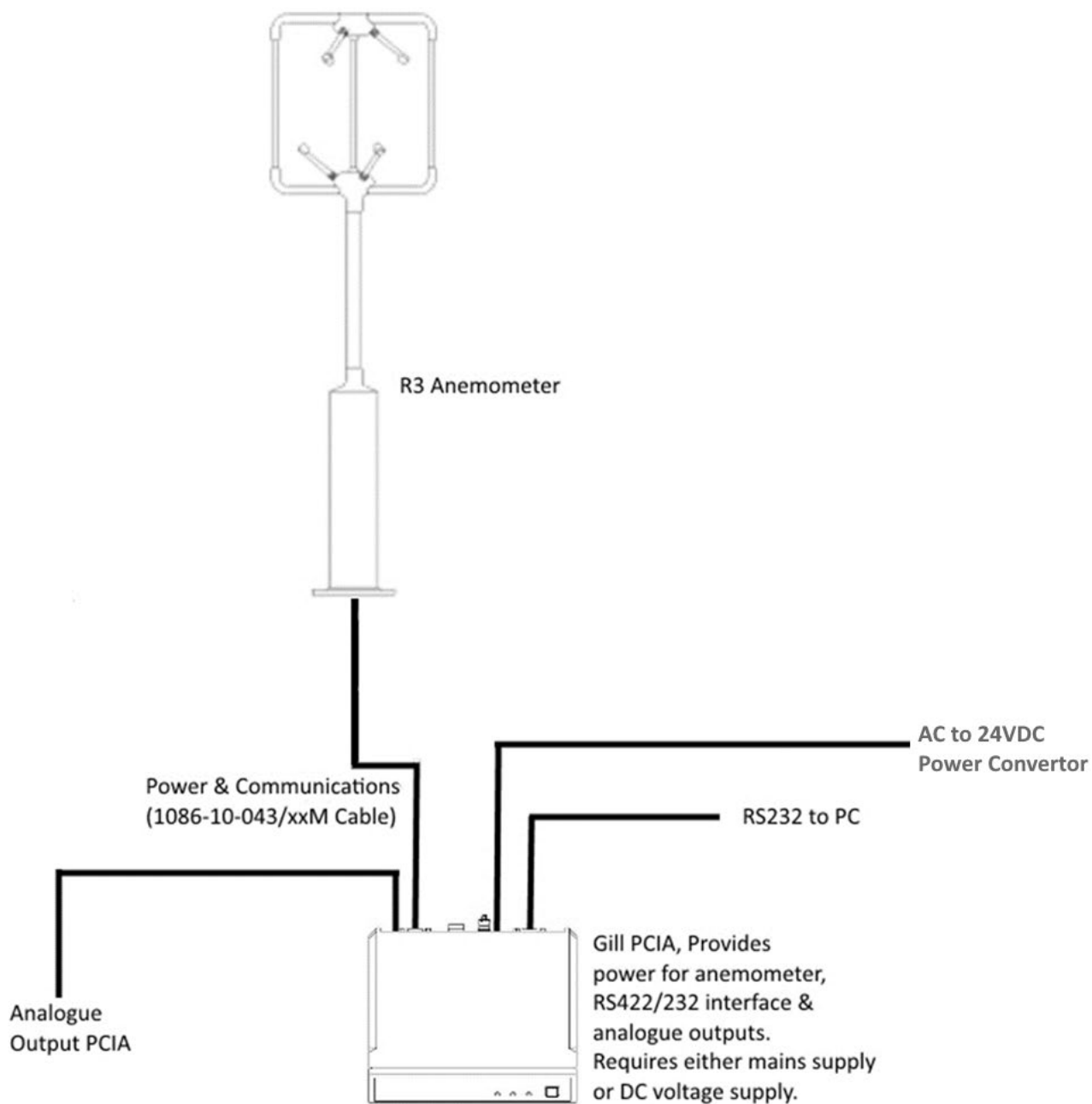
Figure 10 Anemometer connection diagram

4.9.2. System Connection Including Optional SIU

⚠

Gill Cable 1210-00-011 is supplied in a 5 Metre Length.

4.9.3. Interface Cable Connections

20-Way Hirose Connector (R3)			31-Way Hirose Connector (SIU)	
Designation	Pin No.		Pin No.	Designation
Async RX+	4		14	Async RX+
Async RX-	5		1	Async RX-
Async TX+	2		5	Async TX+
Async TX-	3		4	Async TX-
Power +	6		12	Power +
Power -	14		13	Power -
Sync +	18		6	Sync +
Sync -	10		7	Sync -
SPI TX+	20		31	SPI TX+
SPI TX-	16		28	SPI TX-
SPI RX+	15		22	SPI RX+
SPI RX-	8		8	SPI RX-
SPI Clock +	7		24	SPI Clock +
SPI Clock -	19		29	SPI Clock -
$\overline{CS4}$ +	17		19	$\overline{CS4}$ +
$\overline{CS4}$ -	1		18	$\overline{CS4}$ -
Digital GND	13		3	Digital GND
Chassis/Screen	9		23	Chassis/Screen

Figure 11 Interface Cable Connections

4.9.4. 1210-00-011 Interface Cable

The optional 1210-00-011 cable allows for connection between the R3 and the Sensor Input Unit.

i   **Note that cable length should not exceed 5 meters.**

Figure 12 1210-00-011 Interface Cable

5   Using The Anemometer Digital Outputs

5.1.   Digital Serial Output Format

Data is sent in either binary or ASCII format as follows:

5.2.   Binary Result Message Format (post conversion)

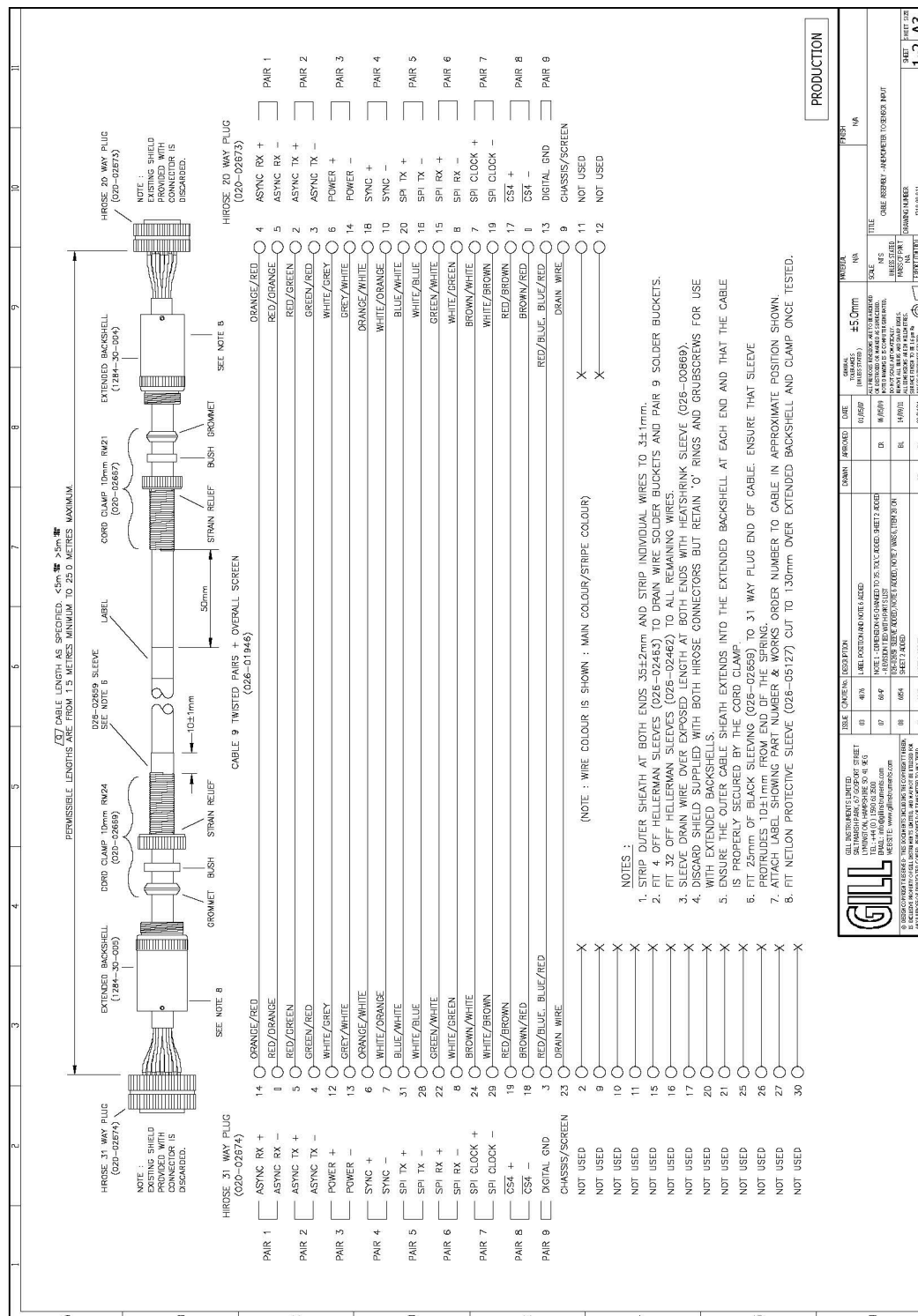| 0xBABA	01	10	176	0.1	0.0	350.4	+99.99	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	2B
Start	StaA	StaD	Wc1	Wc2	Wc3	C	AbsT	An1	An2	An3	An4	An5	An6	cc

where:

0xBA 0xBA	-	Start of result message identifier. 2 bytes, hex value BA.
StaA	-	Status Address
StaD	-	Status Data
Wc_1	-	Wind component 1
Wc_2	-	Wind component 2
Wc_3	-	Wind component 3
C	-	Speed of Sound or Sonic Temperature
T	-	Absolute temperature
A_n	-	Analogue input 1
cc	-	checksum of all bytes. The checksum is an exclusive OR of all bytes excluding the 2 start bytes.

These fields are defined as follows:
Wind Component Fields

UVW format	Wc_1	U axis velocity in 0.01ms^{-1} units (Two's complement signed)
	Wc_2	V axis velocity in 0.01ms^{-1} units (Two's complement signed)
	Wc_3	W axis velocity in 0.01ms^{-1} units (Two's complement signed)
Polar format	Wc_1	U V plane velocity direction in ° relative to N.
	Wc_2	U V plane velocity magnitude in 0.01ms^{-1} units.
	Wc_3	W axis velocity in 0.01ms^{-1} units (Two's complement signed)
Axis Speeds	Wc_1	Ultrasonic axis 1 velocity in 0.01ms^{-1} units (Two's complement signed)
	Wc_2	Ultrasonic axis 2 velocity in 0.01ms^{-1} units (Two's complement signed)
	Wc_3	Ultrasonic axis 3 velocity in 0.01ms^{-1} units (Two's complement signed)

Speed of Sound Field

Speed Of Sound	Speed of sound in 0.01ms^{-1} units (Unsigned)
Sonic Temperature	Sonic temperature in 0.01K (Unsigned) or 0.01°C (Two's complement signed)

Absolute Temperature Field
Absolute Temperature in 0.01K (Unsigned) or 0.01°C (Two's complement signed)

Analogue Input Fields (if using an SIU Box)
Analogue input value in twos complement:
0000   0.0000V
1FFF   +4.9994V
E000   -5.0000V

Checksum Field
Exclusive OR of all bytes excluding the two start bytes.

6 Using Analogue Inputs with Sensor Input Unit Part 1210-PK-016

The Sensor Input Unit allows the user to integrate up to 6 analogue inputs into the R3 digital string, together with a PRT input. It is designed for outdoor use, please see section 13.3 for mounting details.

6.1 Analogue Inputs

The optional Sensor Input Unit provides six differential analogue inputs of 14-bit resolution. A specification for these is given in Appendix A - Technical Specification. This feature allows the user to power extra equipment local to the Sensor Input Unit and to take analogue data from that equipment. The anemometer digitises the analogue data and appends it to the digital data string

A sensor supply voltage is available at each connector. The voltage at this connector is the supply voltage **at the SIU** minus 1.5 volts. The sensor supply voltage is internally regulated to 21±2 volts for SIU supply voltages above 22 volts.

For sensors with a common supply and signal ground, this ground should be connected to Sensor Supply -. In this situation Analogue Input - should be connected to Sensor Supply - and Analogue Ground left floating.

The **total** current drawn from the sensor supply by all the external sensors must not exceed 70mA.

Sensor connector pin out:

1   Sensor power -
2   Analogue input 1+ / 3+ / 5+
3   Analogue ground
4   Analogue input 1- / 3- / 5-
5   Analogue input 2+ / 4+ / 6+
6   Analogue input 2- / 4- / 6-
7   Sensor power +
8   Chassis/screen

6.2   Using the SIU PRT Input

The Sensor Input Unit is set up to operate with any 4 wire PRT conforming to IEC 751 or DIN 43760.

PRT connector pin out:
1   Sensor power +
2   Analogue input 6 +
3   Analogue input 6 -
4   Analogue ground
5   PRT excitation +
6   PRT excitation -
7   PRT sense +
8   PRT sense -
9   Sensor power -
10   Chassis/screen

PRT connection diagram:

PRT excitation +

PRT sense +

PRT 100
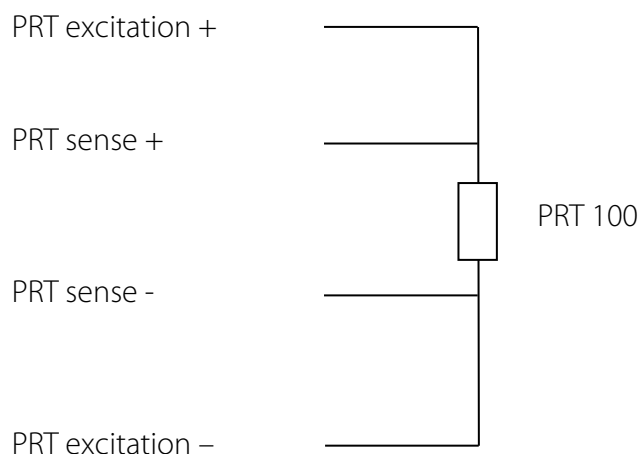
PRT sense -

PRT excitation –

Figure 13 PRT connection diagram

For correct operation the PRT connections must be isolated from the rest of the system.

7 Using Analogue Outputs with PCIA box 1189-PK-030

7.1. Introduction

Analogue outputs can be provided by using the optional PCIA. The analogue output card decodes the serial message from the anemometer and generates the appropriate analogue outputs. Seven analogue outputs are provided of 14-bit resolution. The pin assignment for these is given in Section 5.8.

7.2. Analogue Outputs

Channels 1,2 and 3 – Wind Direction
These channels represent the wind velocity. The variables represented by each channel depend on the anemometer's operating mode, and are defined in the following table:

	Output Channel		
Mode	**1**	**2**	**3**
UVW	U	V	W
Polar format	Dir.	Mag.	W
Axis velocities	Axis 1	Axis 2	Axis 3

For U, V and W magnitude, and axis velocities, ±2.5V represents ±10, ±20, ±30 or ±60m/s as selected when configuring the anemometer. For direction in polar format the ±2.5V output range represents either 360° or 540°. This option is also set up when configuring the anemometer.

The direction representation is:

	Output voltage (V)				
	-2.5	**0.833**	**0**	**+0.833**	**+2.5**
360°	-180°		0°		+180°
540°	0°	180°		360°	+540°

The 540° mode avoids the output oscillating between -2.5V and +2.5V in response to a direction varying around 180°.

Channel 4 – Speed of Sound or Sonic Temperature
The variable represented by this analogue output also depends on the configuration of the anemometer's speed of sound or sonic temperature. The representations for each available mode are:

	Output voltage (V)			
	-2.5	**-1.667**	**0**	**+2.5**
Speed of Sound	300	311.67	335	370
Sonic temperature (Kelvin)		233.15	273.15	333.15
Sonic temperature (Celsius)		-40	0	+60

Channel 5 – Absolute Temperature
The voltage output at a given temperature is independent of the anemometer's temperature output configuration. The following table shows the mapping between voltage and temperature:

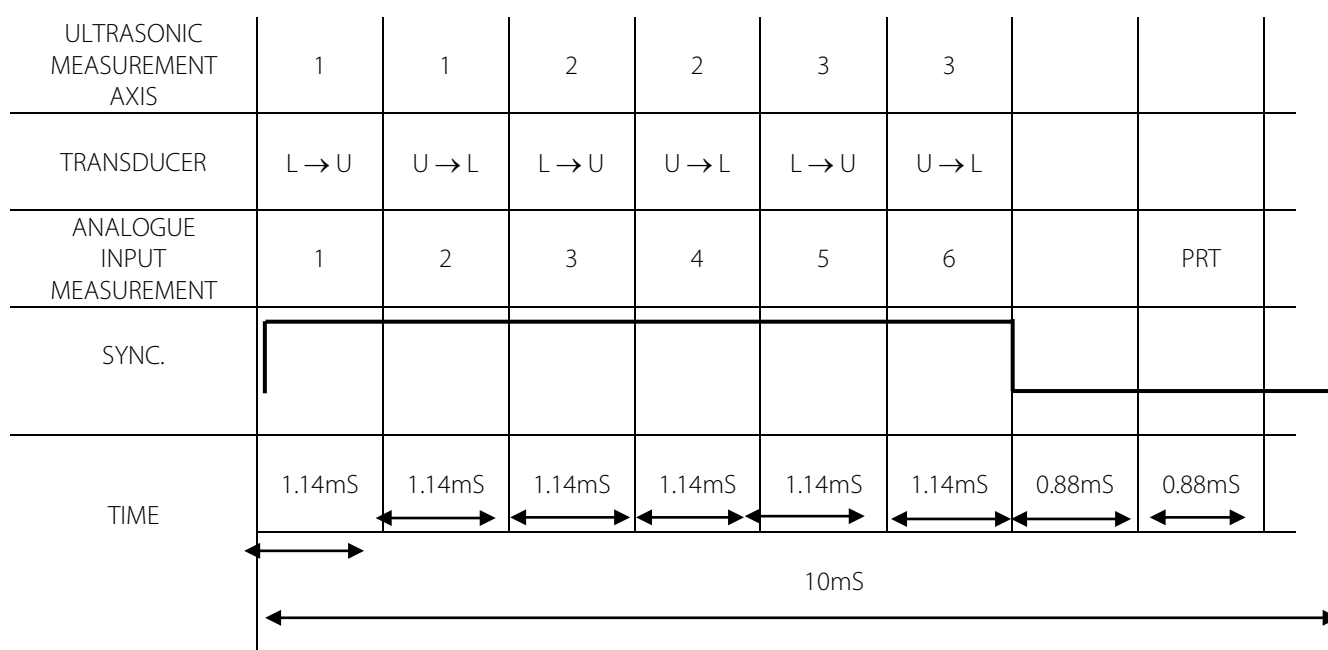|	Output voltage (V)		
	-1.667	**0**	**+2.5**
Celsius	-40	0	+60
Kelvin	233.15	273.15	333.15

Channel 6 – Reserved for future expansion
This analogue output is not currently used.

Channel 7 and 8 - Analogue Inputs/Outputs

Channels 7 and 8 echo the voltage on the lowest two analogue inputs that are enabled i.e. the first two in the serial data message from the anemometer. The analogue inputs at the anemometer are in the range ±5V. The analogue outputs have a range of ±2.5V. The voltage output is half the analogue input value. For example an analogue input of +5V is echoed at +2.5V.

7.3. Analogue Sync. Output

A logic 1 on the Sync/Auxiliary output (pins 6 & 7 of the 9-way D type connector on the PCI/A) indicates that the analogue outputs have settled. A logic 0 is generated during the period when the analogue outputs are being updated (approximately 2ms duration). For full specifications please see section 5.8.

1210-K-068 Measurement Sequence

ULTRASONIC MEASUREMENT AXIS	1	1	2	2	3	3		
TRANSDUCER	L → U	U → L	L → U	U → L	L → U	U → L		
ANALOGUE INPUT MEASUREMENT	1	2	3	4	5	6		PRT
SYNC.								
TIME	1.14mS	1.14mS	1.14mS	1.14mS	1.14mS	1.14mS	0.88mS	0.88mS

10mS

NOTES:

1. L → U indicates lower to upper transducer firing
   U → L indicates upper to lower transducer firing
2. Serial output of the previous measurement commences as SYNC goes high

Figure 14 1210-K-068 Measurement Sequence

7.4. Analogue Status. Output

A logic 1 on the status output (pin 24 wrt signal ground of the 25-way D type connector on the PCIA) indicates that the analogue outputs are valid (i.e. the full set of configuration data have been received from the anemometer and there are no data errors for the current output data). The pin assignment and electrical specification of the status output are contained in Section 4.8

7.5. Test Modes

The analogue output system includes two self-test modes. They are activated by the pulling low the relevant pin on the 25-way D type connector, and remain active until the pin is pulled high or allowed to go open circuit. The pin assignment and electrical specification are contained in section 10.1.4. Pulling Test Pin 1 low causes all eight analogue outputs to simultaneously cycle through the following sequence of voltages:

-2.50v, -1.25v, 0.00v, 1.25v, 2.50v

The outputs remain at each voltage for four seconds so that the sequence repeats every twenty seconds.

Pulling Test Pin 2 low causes the same sequence of voltages to be output on each channel in turn, while the unused channels are held at 0.00v, i.e. the sequence is first output on channel 1, then channel 2, then 3 etc. For this test the complete sequence lasts 160 seconds.

Appendix A - Technical Specification

Parameter	R3-50	R3-100/R3A-100
Outputs		
Data Output rates	From 0.4 to 50Hz	From 0.4 to 100Hz
Measurement Rate	50Hz (Full 3 axis measurement)	100Hz (Full 3 axis measurement)
Format	UVW or Polar (ASCII or Binary)	UVW or Polar (ASCII or Binary)
Wind Speed		
Range	0 - 45 m/s	0 - 45 m/s
Resolution	0.01m/s	0.01m/s
Wind Speed Accuracy *	<1%RMS @ 12m/s	<1%RMS @ 12m/s
Wind Speed Offset	<±0.01ms	<±0.01ms
Direction		
Range	0 – 359°	0 – 359°
Resolution	1^0	1^0
Directional Accuracy *	<±1°RMS	<±1°RMS
Speed of Sound Measurement		
Measurement Rate	50Hz	100Hz
Range	300 -370 m/s	300 -370 m/s
Resolution	0.01 m/s	0.01 m/s
Accuracy *	< ± 0.5% (For wind speeds <30ms)	< ± 0.5% (For wind speeds <30ms)
Supply Input		
Supply Voltage	9 to 30VDC	9 to 30VDC
Anemometer Supply Current	<300mA for 12VDC Input	<300mA for 12VDC Input
	<150mA for 24VDC Input	<150mA for 24VDC Input
SIU Supply Current	<200mA for 12VDC Input	<200mA for 12VDC Input
	<100mA for 24VDC Input	<100mA for 24VDC Input
Environmental		
Operating Temperature	-40℃ to +60℃	-40℃ to +60℃
Storage Temperature	-50℃ to +75℃	-50℃ to +75℃
Altitude	0 to 3000m	0 to 3000m
Moisture/Dust Protection	IP65	IP65
Humidity	5 % to 100 %	5 % to 100 %
Precipitation	Operation up to 300 mm / hour	Operation up to 300 mm / hour
EMC	Emissions BS EN 50081 -1:1992	Emissions BS EN 50081 -1:1992
	Immunity BS EN 50082 -1:1992	Immunity BS EN 50082 -1:1992
Input/Output Protection	>0.8J	>0.8J
Serial Interface		
Electrical Interface	Full Duplex RS422	Full Duplex RS422
Baud Rates	2400, 4800, 9600, 19200, 38400, 57600, 115200	2400, 4800, 9600, 19200, 38400, 57600, 115200
Format	8 data bits, 1 stop bit, No Parity	8 data bits, 1 stop bit, No Parity
Analogue Inputs		
Sampling Rate: measurement	50Hz Synchronous to wind	100Hz Synchronous to wind
Diff. Input Voltage Range	-5.000V to +5.000V	-5.000V to +5.000V
Accuracy	>0.05% of full scale	>0.05% of full scale
Resolution	14 bits	14 bits
Common Mode Input Range	>±8v	>±8v
Input Impedance	>1MΩ (Differential)	>1MΩ (Differential)
	>1MΩ (Common Mode)	>1MΩ (Common Mode)
PRT		
Resolution	0.01℃	0.01℃
Measurement Accuracy	<±0.1℃ (-40 to +50℃)	<±0.1℃ (-40 to +50℃)
	<±0.15℃ (+50 to +60℃)	<±0.15℃ (+50 to +60℃)
Anemometer Sync Output	RS422 synchronous to Wind Measurement	RS422 synchronous to Wind Measurement

* Accuracy specification R3-50 and R3-100 applies for wind speeds less than 32m/s and for wind incidence up to ±20°.
* Accuracy specification R3A-100 applies for wind speeds less than 32m/s and for wind incidence <±150° in the horizontal plane and up to ±50° from the horizontal.

Appendix B - Cable Assembly

Way Hirose Connector
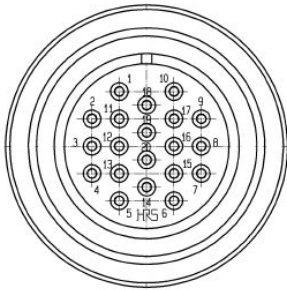

Figure 15 Pin Connections, rear of 20-way Hirose

Figure 16 Pin Connections, contact side of 20-way Hirose

Pin Number	Designation
1	Reserved
2	RS422 Tx+
3	RS422 Tx-
4	RS422 Rx+
5	RS422 Rx-
6	Supply +ve
7	Reserved
8	Reserved
9	Chassis
10	Anemometer Sync -
11	Not Connected
12	Not Connected
13	Digital 0v
14	Supply –ve
15	Reserved
16	Reserved
17	Reserved
18	Anemometer Sync +
19	Reserved
20	Reserved

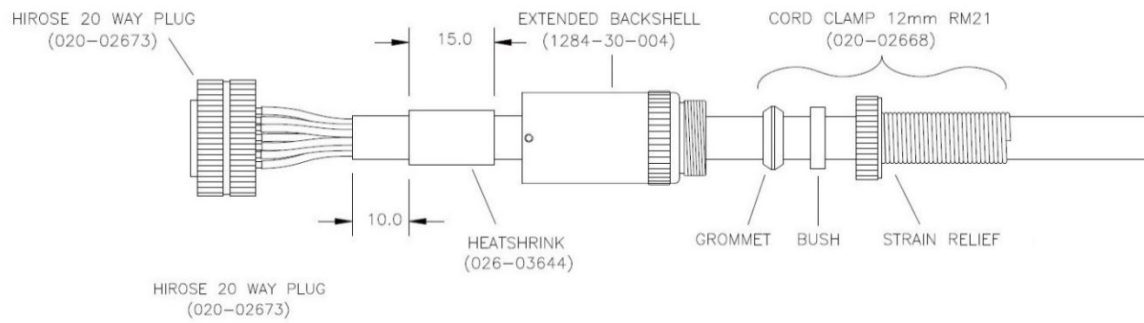Assembly of the 20-way Hirose connector is shown below

Figure 17 Assembly of the 20-way Hirose connector

The outer sheath needs to be cut back by 45mm and the individual wires need to have their insulation stripped back by 3mm
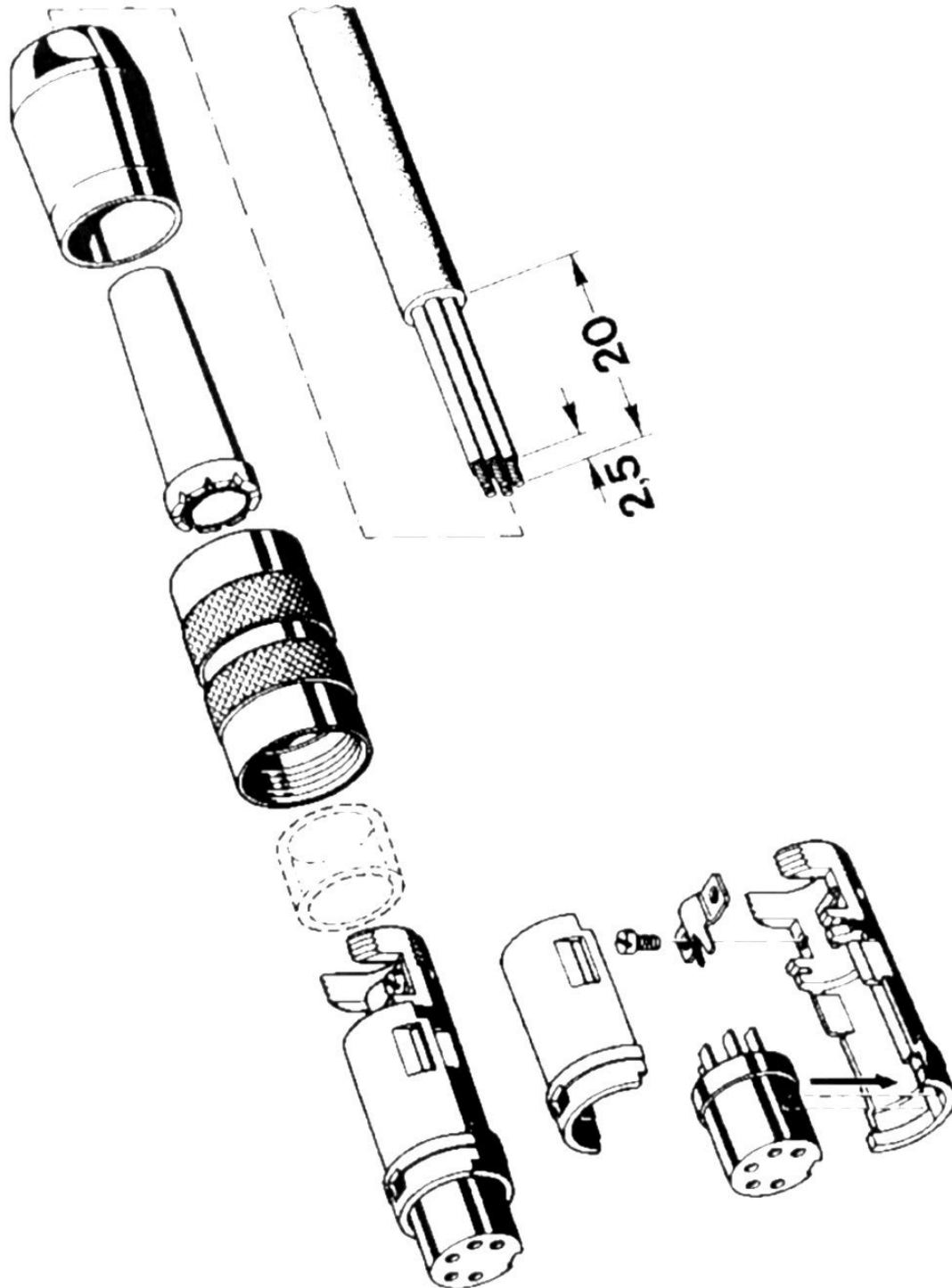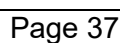
Figure 18 Gill Instruments R3/SIU to PCI/A ready-made Gill Cable 1210-PK-043 - The optional 1086-10-043 cable allows for connection between either the PCI/PCIA and R3 or the SIU.

Figure 19 R3 Anemometer Cable

Appendix C - R3 Default Setup

ASCII Result Message Format

2	1	10	176	0.06	0.03	350.4	99.99	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	3	2B	CR
stx	StaA	StaD	Wc1	Wc2	Wc3	C	AbsT	An1	An2	An3	An4	An5	An6	etx	cc	term

where:

<STX>	-	Start of string character (ASCII value 2)
StaA	-	Status Address
StaD	-	Status Data
Wc_1	-	Wind component 1
Wc_2	-	Wind component 2
Wc_3	-	Wind component 3
C	-	Speed of sound/sonic temperature
T	-	Absolute temperature
A_1	-	Analogue input 1
A_n	-	Analogue input n.
<ETX>	-	End of string character (ASCII value 3)
cc	-	checksum of all characters between <STX> and <ETX>
<TERM>	-	<CR> or <CR><LF>, user selectable

These fields are defined as follows:
Wind Component Fields

UVW format	Wc_1	U axis velocity in $0.01ms^{-1}$ units (±UU.UU)
	Wc_2	V axis velocity in $0.01ms^{-1}$ units (±VV.VV)
	Wc_3	W axis velocity in $0.01ms^{-1}$ units (±WW.WW)
Polar format	Wc_1	U V plane velocity direction in ° relative to N (DDD)
	Wc_2	U V plane velocity magnitude in $0.01ms^{-1}$ units (MM.MM)
	Wc_3	W axis velocity in $0.01ms^{-1}$ units.(±WW.WW)
Axis Speeds	Wc_1	Ultrasonic axis 1 velocity in $0.01ms^{-1}$ units ($±A_1A_1.A_1A_1$)
	Wc_2	Ultrasonic axis 2 velocity in $0.01ms^{-1}$ units ($±A_2A_2.A_2A_2$)
	Wc_3	Ultrasonic axis 3 velocity in $0.01ms^{-1}$ units ($±A_3A_3.A_3A_3$)

Speed of Sound Field

Speed Of Sound	Speed of sound in $0.01ms^{-1}$ units (CCC.CC)
Sonic Temperature	Sonic temperature in 0.01K (KKK.KK) or 0.01°C (±CC.CC)

Absolute Temperature Field
Absolute Temperature in 0.01K or 0.01°C (TTT.TT) or 0.01°C (±CC.CC)

Analogue Input Fields (if using an SIU Box)
Analogue input value in volts (±v.vvvv)

Checksum Field
Exclusive OR of all characters between <STX> and <ETX> reported as ASCII hex.

Default Configuration Command Settings

Factory settings are:-

```
AVERAGE              5
WINDREP              UVW CAL
SOSREP               SONICTEMP K
ABSTEMP              OFF
ANAIP                DDDDDD (DISABLED)
AOPFSD               30
POLARWRAP            360
STRFMT               ASCII UNPAD
ASCTERM              CRLF
ECHO                 ON
MSGMODE              CONT
BAUD                 9600
CTONE                ON
ALIGN                AXIS
INST                 OFF
```

Default Output Data String

The Structure of the Factory R3 Default Output Data String is as follows:-

Status Codes, U, V, W, Speed of Sound, Checksum.

```
01,00,-00.04,+00.00,+00.03,293.94,1E
02,28,-00.04,+00.00,+00.03,293.94,17
03,00,-00.04,-00.02,+00.03,293.94,18
04,00,-00.05,-00.02,+00.04,293.94,19
05,00,-00.04,-00.03,+00.03,293.95,1E
06,01,-00.05,-00.02,+00.04,293.94,1A
```

# Appendix D – Configuring the Anemometer with a PC Running Gill Wind Software

▶

Wind is a software package from Gill Instruments that is free to download from the Gill Instruments website:

http://gillinstruments.com/main/software.html

It is primarily designed for use with the WindSonic and WindMaster range of anemometers but it is possible to use as a terminal package to communicate with the R3. The tool features are not applicable.
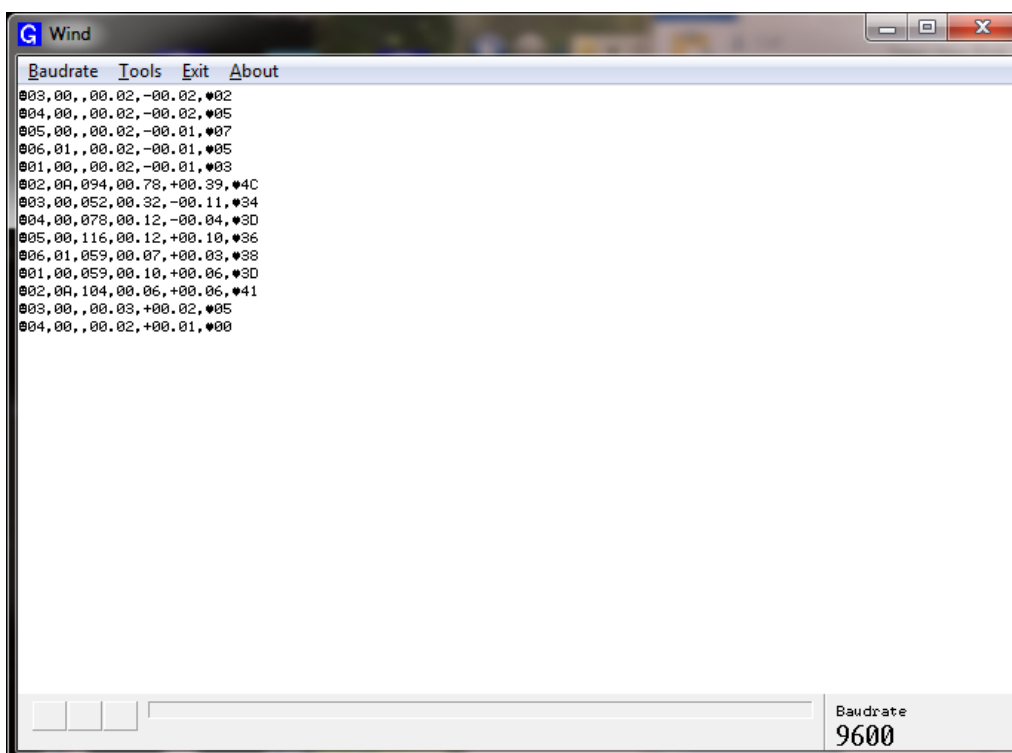
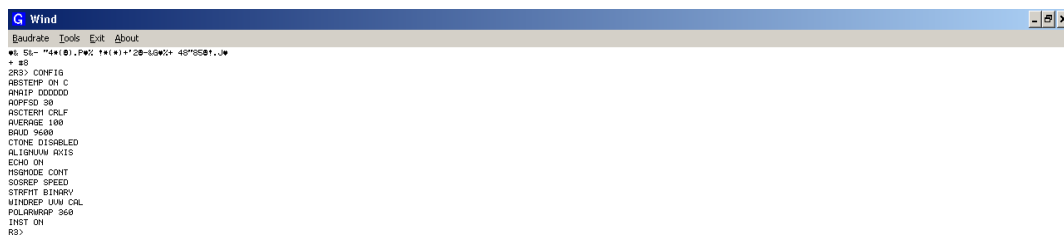To begin, open the Wind software and select the required serial port.
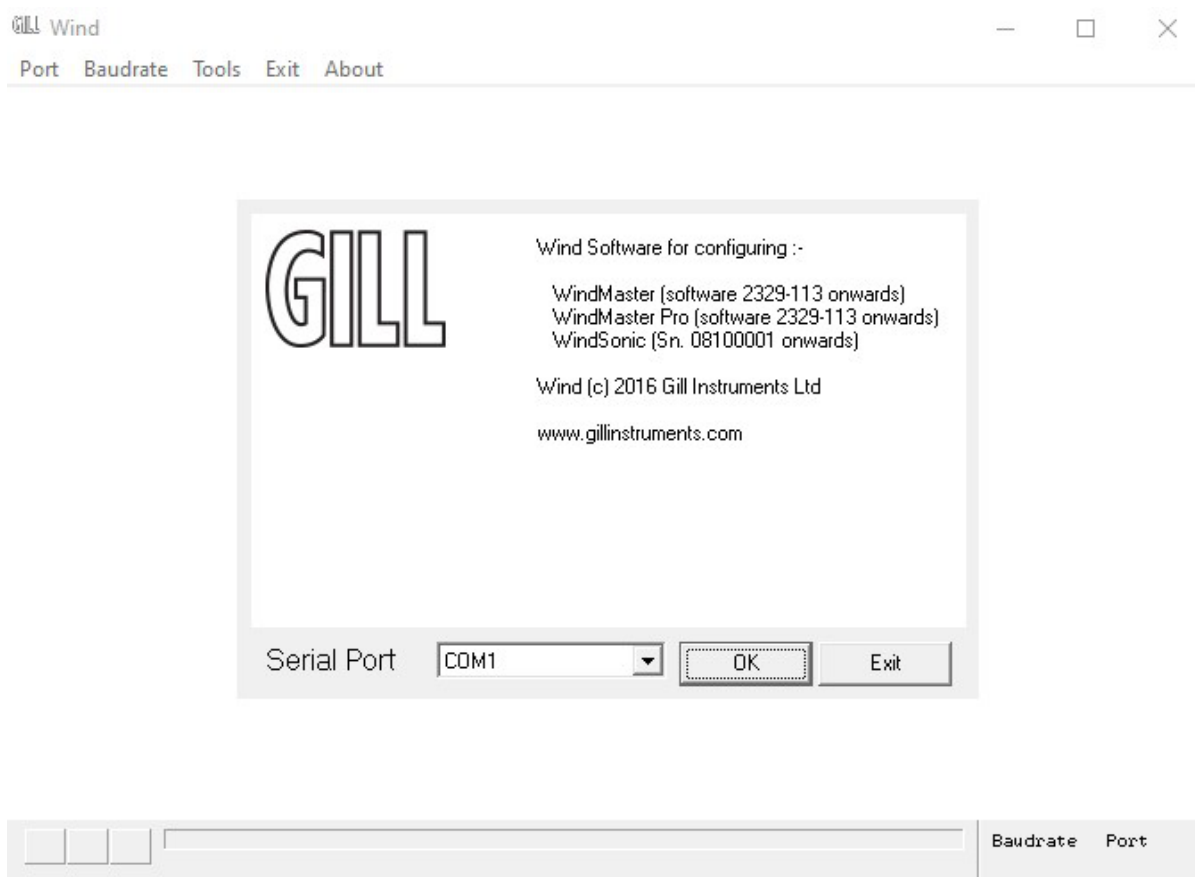
Click on the Baud rate menu and select the required Baud rate to match the R3.
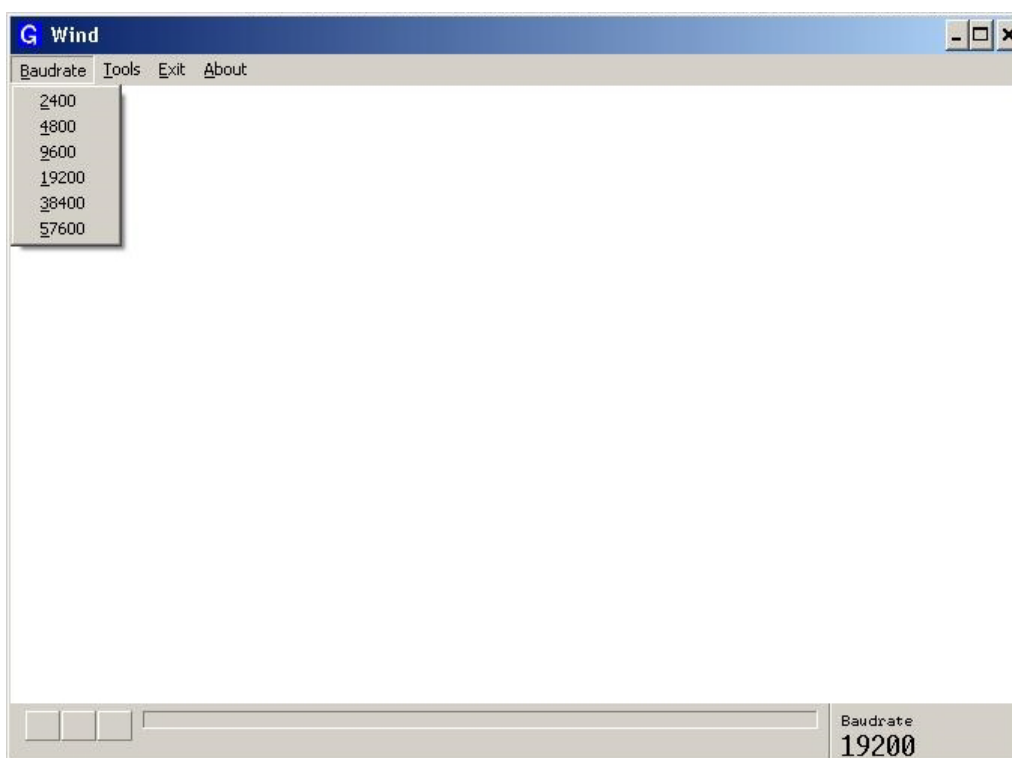
Data will start scrolling in the terminal window (assuming that the R3 is configured to output in Gill ASCII mode)

To enter configuration mode, type '**IM**', then type config and press the enter key to display the current R3 configuration.

Software commands Introduction

Command Format

All commands are entered as an ASCII string consisting of a mnemonic, representing the operation, and zero or more parameters separated by spaces and terminated by either <CR> or <CR><LF>. The case of the characters in the command is ignored.

Commands are only valid whilst in the interactive mode, with the exception of the "enter interactive mode" command and polled data request command.

ASCII Output String Termination

The ASCII output string terminator can be configured to be either <CR> or <CR><LF>. The expression <TERM> is used to indicate either one of these string terminators.

Character Echo

Character echo can be enabled or disabled. If enabled, received characters are only echoed while in interactive mode.

The Backspace Character

The anemometer will respond to the <BACKSPACE> character by deleting the previous character from its command buffer, and echo <BACKSPACE><SPACE><BACKSPACE>.

The Escape Character

The anemometer will respond to the <ESC> character by deleting all characters currently in its command buffer, and echo <TERM><TERM>.

Command Responses

Command responses are only issued when in interactive mode.

Configuration Commands

On receipt of a configuration command, the anemometer will respond with a validation message if the command was successfully completed, or an appropriate error message if it was not. If a configuration command is entered with no data parameter, the current data value is returned.

Interrogation Commands

On receipt of an interrogation command, the anemometer responds with the requested information if the command was successfully actioned, or an appropriate error message if it was not.

Invalid Combinations of Commands

It is possible through the setting of various parameters to request a configuration where the required output bit rate exceeds the configured baud rate.
If an issued configuration command requests a parameter change that would cause the above situation, an appropriate error message is generated.

Software Commands

|	Option, one option from a list separated by the vertical bar must be included in the command.
()	Parenthesis, used to make the possible combinations unambiguous.
[]	Option, the symbols within the square braces are optional.
n{}m	Repeat, the symbols inside the braces can be repeated n to m times. If n is not included then 0 is implied, if m is not present then infinity is implied.
<>	Non-literal symbol, this represents other non-literal and literal symbols. A further definition is required to define this non-literal symbol.

Note: Parameters in **bold** are the default settings.

?
Syntax: ? followed by sending CR/LF (pressing the Enter Key).
Description: Request the current results message when in polled mode.

ABSTEMP
Syntax: ABSTEMP OFF | (ON K | C)
Description: Enables and disables absolute temperature reporting from the PRT sensor.
Parameters: **OFF   PRT temperature reporting turned off.**
                      ON   PRT temperature reporting turned on.
                      K   PRT temperature reporting in K.
                      C   PRT temperature reporting in °C.

ALIGNUVW
Syntax: ALIGNUVW AXIS | SPAR
Description: Selects UVW axis alignment from two alternative definitions.
Parameters: **AXIS   Align the U axis to transducer axis 1 when viewed from above**.
                      SPAR   Aligns the U axis with the North spar.

ANAIP
Syntax: ANAIP <ipno>{,< ipno> }6 (D | E)
                      <ipno> = 1 | 2 | 3 | 4 | 5 | 6
Description: Turns on or off the specified analogue inputs.
Parameters: ipno Analogue input channel number.
                      D   Disable specified channels.
                      E   Enable specified channels.

                      Example:R3> ANAIP 1,3,5 E
                                         R3> VANAIP

AOPFSD

Syntax:	AOPFSD 10 | 20 | **30** | 60 *(Metres Per Second Only)*
Description:	Specifies the analogue outputs full scale deflection. Used to configure the analogue output box only.

ASCTERM

Syntax:	ASCTERM CR | CRLF	
Description:	Sets ASCII output string terminator.	
Parameters:	CR	ASCII output string terminator is <CR>.
	CRLF	**ASCII output string terminator is <CR><LF>.**

AVERAGE (Output Rate Setting)

Syntax:	AVERAGE 2.to.250 (R3-50) or 1 to 250 (R3-100)
Description:	Sets the number of samples used in the block average. Default is **5.**

Output rate frequency is calculated from 100/Average setting.

e.g. Default Average Setting is 5 therefore Output Rate = 100/5 = 20Hz.

⚠️

If using all 6 analogue inputs then the Average setting must be 50 or more for a Baud rate of 9600, alternatively user a much higher Baud Rate setting.

BAUD

Syntax:	BAUD 2400 | 4800 | **9600** | 19200 | 38400 | 57600 | 115200
Description:	Sets the serial interface baud rate. Selection must be confirmed with a letter B.

Example of Baud Rate change in a terminal package, assuming R3 is in default 9600 Baud:

R3> baud 19200 <CR>   ***At this point the Baud Rate of the terminal package must be changed to that of the new setting for the R3, any delay may result in an error message.***

Confirm> b <CR>
VBAUD
R3> exit

Note: In general the more parameters required in the output data string and the faster the output rate the higher must be the Baud rate to get a fully reported data string or change a parameter setting.

CONFIG

Syntax:	CONFIG
Description:	Reports the anemometer's configuration.

CTONE

Syntax:	CTONE ON | OFF | DISABLE	
Description:	Enables an audible confidence tone	
Parameters:	**ON**	**Enables the confidence tone**
	OFF	Disables the tone until the anemometer is next powered up.
	DISABLE	Disables the tone until the function is enabled using CTONE ON.

ECHO

Syntax:	ECHO OFF | ON	
Description:	Turns on or off character echoing.	
Parameters:	OFF	Turn off character echoing.
	ON	**Turn on character echoing.**

EXIT

Syntax: EXIT
Description: Exits from interactive mode back to measurement mode.

HELP

Syntax: HELP
Description: Reports a brief description of all the available commands.
Syntax: HELP command
Description: Reports a description of the command requested.

IM

Syntax: IM
Description: Switches from measurement mode to interactive mode.

INST

Syntax: INST ON | **OFF**
Description: When set to ON, Instantaneous Mode is enabled and no averaging is performed. When set to OFF, Instantaneous Mode is disabled and averaging is performed. In both cases the output rate is determined by the AVERAGE parameter.

MSGMODE

Syntax: MSGMODE CONT | POLL
Description: Sets the message reporting mode.
Parameters: **CONT   Result messages are reported continuously.**
                 POLL   Result messages are requested by the user.

POLARWRAP

Syntax: POLARWRAP **360** | 540
Description: Specifies the analogue outputs polar reporting wrap angle. Used to configure the analogue output box only.

SN

Syntax: SN
Description: Reports the anemometer's serial number.

SOSREP

Syntax: SOSREP OFF | SPEED | (SONICTEMP K | C)
Description: Sets the speed of sound reporting format.
Parameters: OFF   SOS reporting is turned off.
                 SPEED   SOS is reported as speed.
                 SONICTEMP   SOS is reported as sonic temperature.
                 K   Sonic temperature reporting in K.
                 C   Sonic temperature reporting in °C.

                 Example:R3> SOSREP SONICTEMP C <CR>
                 *   VSOSREP*

STRFMT

Syntax:	STRFMT BINARY | ASCII (PAD | UNPAD)
Description:	Sets the result message string format.
Parameters:	BINARY Binary result message format.

ASCII   **ASCII result message format.**
PAD   ASCII fields padded to fixed size (padded with 9's if a measurement is not possible).
UNPAD   ASCII fields unpadded (,, shown if a measurement is not possible).

VER

Syntax:	VER
Description:	Reports the anemometer's software version.

VERIFY

Syntax:	VERIFY E/D
Description:	Enables or disables messages to verify that commands have been carried out. The verification message is the command name prefixed by "V". e.g. "VAVERAGE" for and "AVERAGE" command.
Parameters:	E enables verification messages.
	D disables verification messages.

WINDREP

Syntax:	WINDREP (**UVW** | POLAR) (**CAL** | UNCAL) | AXIS
Description:	Sets the wind measurement reporting format.
Parameters:	**UVW** **Reports wind velocity in UVW format.**

POLAR   Reports wind velocity in polar + W format.
AXIS   Reports wind as axis velocities.
CAL   **Wind results are calibrated.**
UNCAL   Wind results are uncalibrated.

Appendix E – Viewing & Logging the data using Gill Windview software

▶

WindView is a software package from Gill Instruments that is free to download from the Gill Instruments website:

http://gillinstruments.com/main/software.html

It is designed to allow the user to view and log data from a single or multiple anemometers.

Please note that WindView does not allow 2-way communication with the connected anemometer, so any configuration of the R3 must take place prior to connection to WindView.

To begin, open the WindView software package and select the required serial port

Open WindView Software.
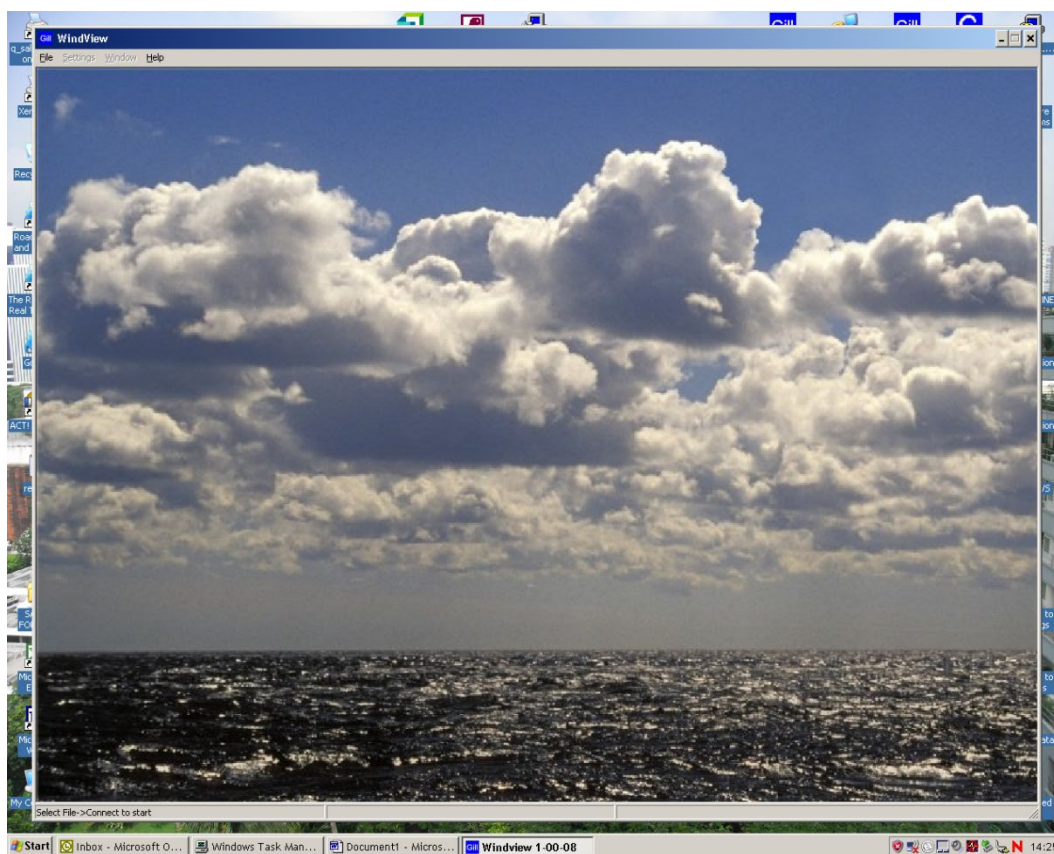
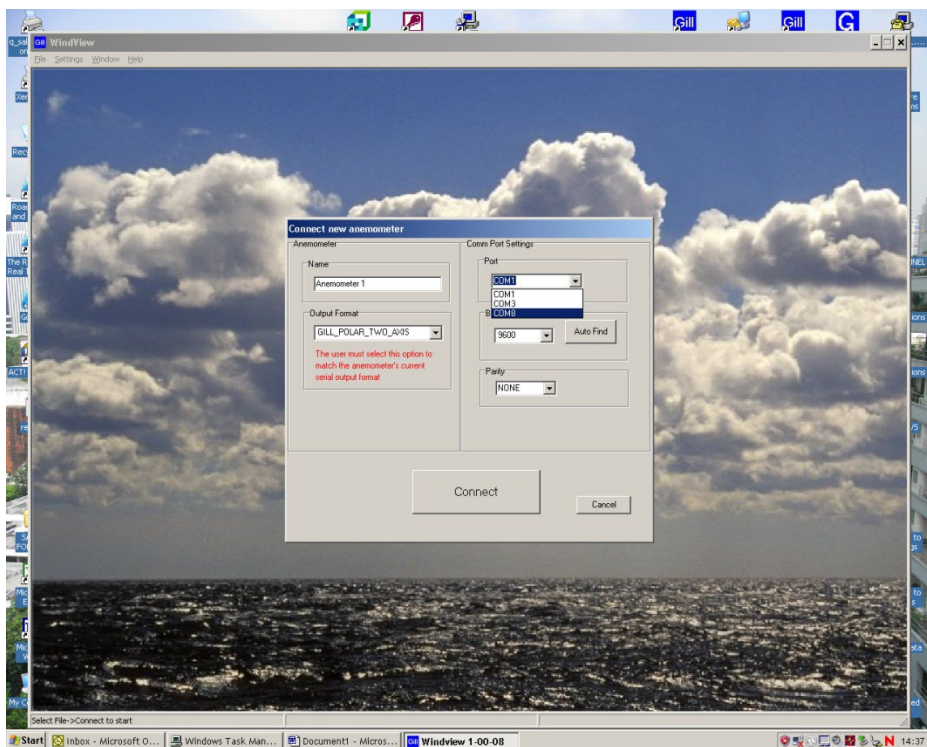Select Connect from the File Drop down menu.
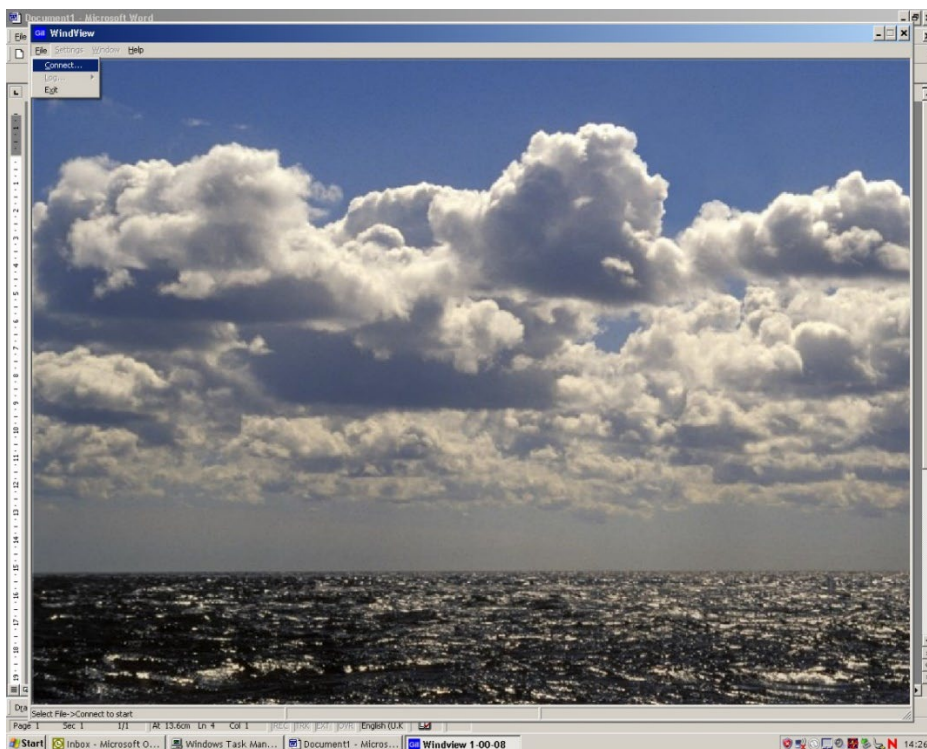
The Output Format field should match the sensor i.e. Gill Polar, 3 axis UV or NMEA.
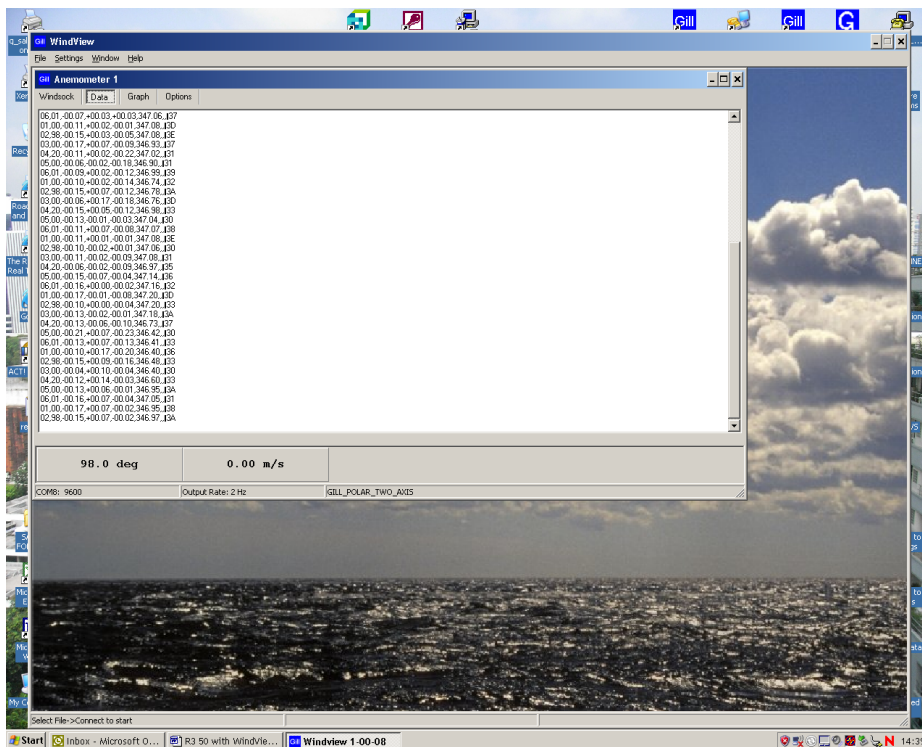Select the required COM Port from the menu.
Select the required baud rate to match the sensor e.g. 9600 baud.
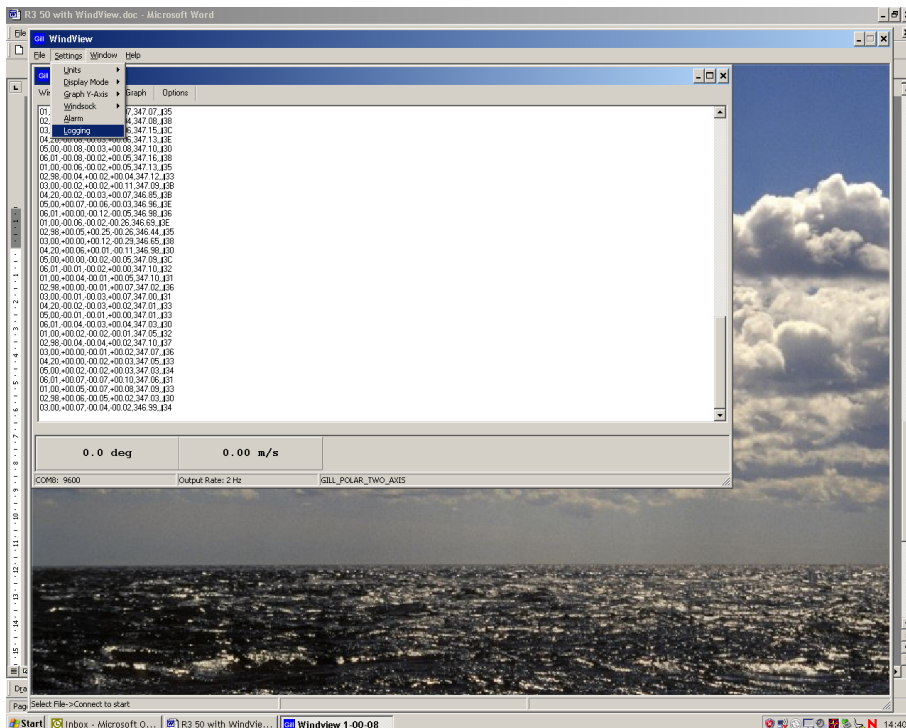Leave Parity set for none.
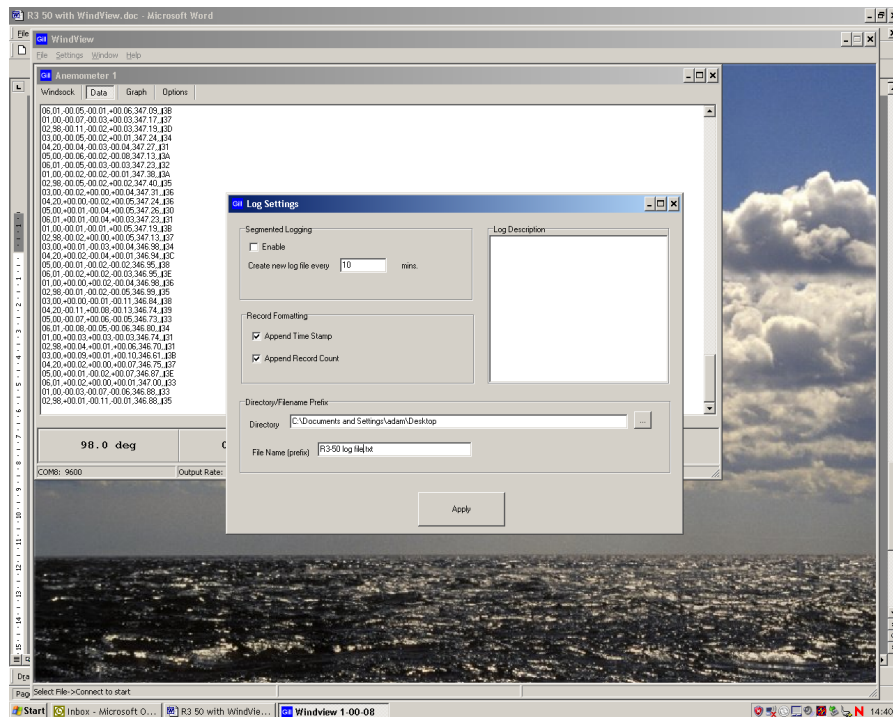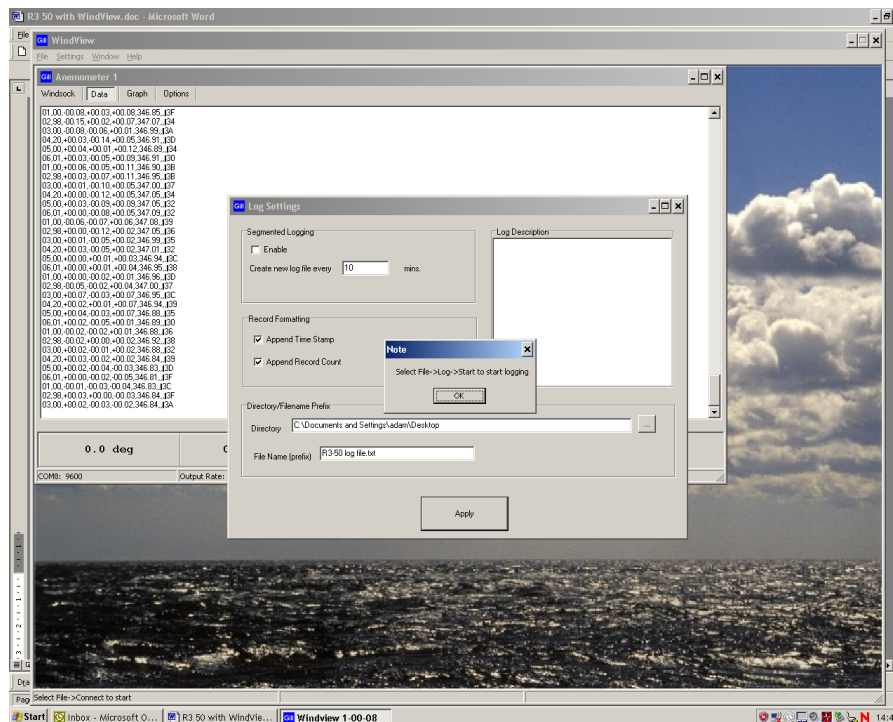Click on Connect.

Data should scroll on screen.
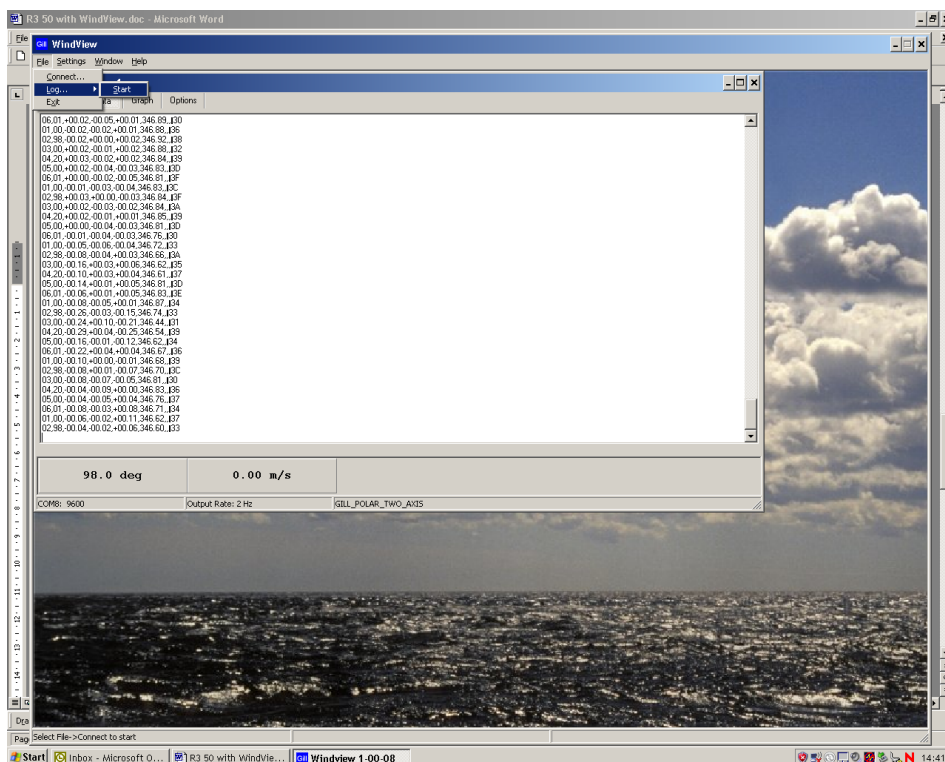

To Log data use Settings menu and select logging.

Select type of log, in this case continuous with boxes ticked for append time stamp and append record count if required.
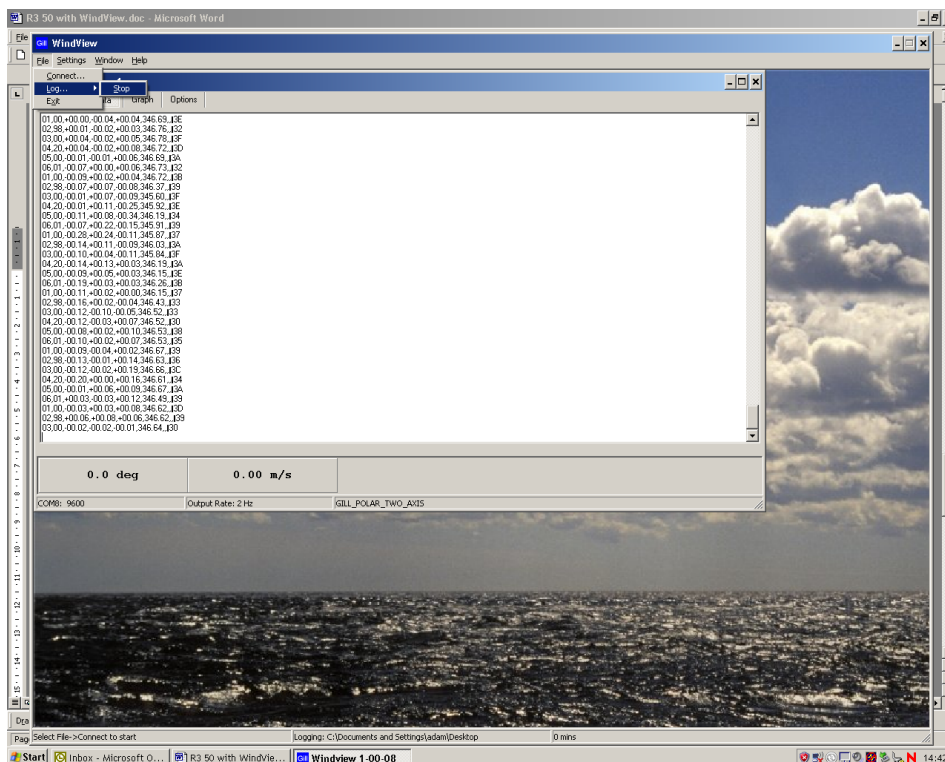Select a file directory and file name.
Click on Apply.

Click on OK

To Start the Logging Select File/Log/Start.

To Stop the Logging Select File/Log/Stop.

Example R3 data logged Notepad.

R3-50 temp Gill Log [Anemometer 1]-1.txt - Notepad

File Edit Format View Help

```
windview Log File
Name: Anemometer 1
Output Format: GILL_POLAR_TWO_AXIS
Log file opened: 30/06/2009 14:07:01

03,01,+00.00,-00.01,-00.01,+25.06,+22.08,+0.4507,⌂3D,0,30/06/2009 14:07:01
04,00,-00.01,+00.00,-00.01,+25.05,+22.06,+0.4519,⌂39,1,30/06/2009 14:07:01
05,00,+00.00,-00.01,-00.01,+25.05,+22.06,+0.4519,⌂38,2,30/06/2009 14:07:01
06,01,+00.00,-00.01,-00.01,+25.05,+22.05,+0.4507,⌂36,3,30/06/2009 14:07:02
01,02,+00.00,-00.01,-00.01,+25.05,+22.08,+0.4507,⌂3F,4,30/06/2009 14:07:02
02,B8,+00.01,-00.02,-00.01,+25.05,+22.08,+0.4515,⌂45,5,30/06/2009 14:07:02
03,01,+00.00,-00.01,-00.01,+25.05,+22.01,+0.4512,⌂33,6,30/06/2009 14:07:02
04,00,+00.00,-00.01,-00.01,+25.05,+22.05,+0.4521,⌂31,7,30/06/2009 14:07:02
05,00,+00.00,-00.01,-00.01,+25.05,+22.07,+0.4515,⌂35,8,30/06/2009 14:07:02
06,01,+00.00,-00.01,-00.01,+25.05,+22.10,+0.4507,⌂32,9,30/06/2009 14:07:02
01,02,+00.01,-00.02,-00.01,+25.04,+22.05,+0.4521,⌂35,10,30/06/2009 14:07:02
02,B8,+00.00,-00.01,-00.01,+25.04,+22.02,+0.4515,⌂4C,11,30/06/2009 14:07:02
03,01,+00.00,-00.01,-00.01,+25.04,+22.08,+0.4516,⌂3F,12,30/06/2009 14:07:02
04,00,+00.00,-00.02,-00.01,+25.03,+22.05,+0.4507,⌂30,13,30/06/2009 14:07:03
05,00,+00.00,-00.02,+00.00,+25.03,+22.01,+0.4513,⌂37,14,30/06/2009 14:07:03
06,01,+00.00,-00.02,+00.00,+25.03,+22.06,+0.4512,⌂33,15,30/06/2009 14:07:03
01,02,+00.00,-00.02,+00.00,+25.03,+22.10,+0.4519,⌂3B,16,30/06/2009 14:07:03
02,B8,+00.00,-00.02,+00.00,+25.03,+22.02,+0.4518,⌂42,17,30/06/2009 14:07:03
03,01,+00.00,-00.02,+00.00,+25.03,+22.06,+0.4513,⌂36,18,30/06/2009 14:07:03
04,00,+00.00,-00.02,+00.00,+25.03,+22.02,+0.4512,⌂34,19,30/06/2009 14:07:03
05,00,+00.00,-00.02,+00.00,+25.03,+22.05,+0.4508,⌂38,20,30/06/2009 14:07:03
06,01,+00.00,-00.02,+00.00,+25.03,+22.06,+0.4508,⌂38,21,30/06/2009 14:07:03
01,02,+00.00,-00.02,+00.00,+25.03,+22.03,+0.4515,⌂35,22,30/06/2009 14:07:03
02,B8,+00.00,-00.02,+00.00,+25.03,+22.06,+0.4515,⌂4B,23,30/06/2009 14:07:04
03,01,+00.00,-00.02,+00.00,+25.03,+22.02,+0.4502,⌂33,24,30/06/2009 14:07:04
04,00,+00.00,-00.02,+00.00,+25.03,+22.03,+0.4495,⌂3B,25,30/06/2009 14:07:04
05,00,+00.00,-00.02,+00.00,+25.03,+22.06,+0.4510,⌂33,26,30/06/2009 14:07:04
06,01,+00.00,-00.02,+00.00,+25.02,+22.05,+0.4512,⌂31,27,30/06/2009 14:07:04
01,02,+00.00,-00.02,+00.00,+25.03,+22.03,+0.4513,⌂33,28,30/06/2009 14:07:04
02,B8,+00.00,-00.02,+00.00,+25.02,+22.06,+0.4515,⌂4A,29,30/06/2009 14:07:04
03,01,+00.00,-00.02,+00.00,+25.01,+22.06,+0.4519,⌂3F,30,30/06/2009 14:07:04
04,00,+00.00,-00.02,+00.00,+25.01,+22.05,+0.4522,⌂32,31,30/06/2009 14:07:04
05,00,+00.00,-00.02,+00.00,+25.01,+22.07,+0.4513,⌂33,32,30/06/2009 14:07:04
06,01,+00.00,-00.01,+00.01,+25.01,+22.03,+0.4512,⌂36,33,30/06/2009 14:07:05
01,02,+00.00,-00.01,+00.01,+25.01,+22.02,+0.4519,⌂38,34,30/06/2009 14:07:05
02,B8,+00.00,-00.01,+00.01,+25.01,+22.06,+0.4527,⌂4A,35,30/06/2009 14:07:05
03,01,+00.00,-00.01,+00.01,+25.01,+22.07,+0.4519,⌂3C,36,30/06/2009 14:07:05
04,00,-00.01,-00.02,+00.01,+25.01,+22.05,+0.4527,⌂31,37,30/06/2009 14:07:05
05,00,+00.00,-00.01,+00.01,+25.01,+22.09,+0.4522,⌂3D,38,30/06/2009 14:07:05
06,01,-00.01,-00.02,+00.01,+25.01,+22.04,+0.4516,⌂31,39,30/06/2009 14:07:05
01,02,-00.01,-00.02,+00.01,+25.01,+22.08,+0.4481,⌂36,40,30/06/2009 14:07:05
02,B8,-00.01,+00.00,+00.01,+25.01,+22.06,+0.4516,⌂48,41,30/06/2009 14:07:05
03,01,-00.01,+00.00,+00.01,+25.02,+22.04,+0.4516,⌂37,42,30/06/2009 14:07:05
04,00,-00.01,+00.00,+00.01,+25.02,+22.04,+0.4499,⌂33,43,30/06/2009 14:07:06
05,00,-00.01,-00.01,+00.02,+25.02,+22.11,+0.4513,⌂31,44,30/06/2009 14:07:06
06,01,-00.01,-00.01,+00.02,+25.02,+22.05,+0.4525,⌂33,45,30/06/2009 14:07:06
01,02,-00.01,+00.00,+00.01,+25.01,+22.06,+0.4516,⌂33,46,30/06/2009 14:07:06
02,B8,-00.01,-00.01,+00.02,+25.02,+22.04,+0.4522,⌂4A,47,30/06/2009 14:07:06
03,01,-00.01,+00.00,+00.01,+25.01,+22.05,+0.4508,⌂3E,48,30/06/2009 14:07:06
04,00,-00.01,+00.00,+00.01,+25.01,+22.05,+0.4507,⌂37,49,30/06/2009 14:07:06
05,00,-00.02,+00.00,+00.01,+25.01,+22.05,+0.4505,⌂37,50,30/06/2009 14:07:06
06,01,-00.01,-00.01,+00.01,+25.01,+22.05,+0.4519,⌂3B,51,30/06/2009 14:07:06
01,02,+00.00,-00.01,+00.01,+25.01,+22.05,+0.4518,⌂3E,52,30/06/2009 14:07:06
02,B8,+00.00,-00.01,+00.01,+25.01,+22.06,+0.4516,⌂48,53,30/06/2009 14:07:07
03,01,-00.01,-00.01,+00.01,+25.01,+22.05,+0.4522,⌂30,54,30/06/2009 14:07:07
04,00,-00.01,+00.00,-00.01,+25.01,+22.08,+0.4524,⌂3D,55,30/06/2009 14:07:07
05,00,-00.01,-00.01,+00.00,+25.01,+22.06,+0.4513,⌂36,56,30/06/2009 14:07:07
06,01,-00.01,+00.00,+00.00,+25.01,+22.03,+0.4516,⌂34,57,30/06/2009 14:07:07
01,02,-00.01,+00.00,-00.01,+25.00,+22.03,+0.4516,⌂31,58,30/06/2009 14:07:07
02,B8,-00.01,+00.00,-00.01,+25.00,+22.08,+0.4519,⌂4E,59,30/06/2009 14:07:07
03,01,-00.01,+00.00,-00.01,+25.01,+22.01,+0.4513,⌂36,60,30/06/2009 14:07:07
04,00,-00.01,+00.00,-00.01,+25.01,+22.06,+0.4524,⌂33,61,30/06/2009 14:07:07
05,00,-00.01,+00.00,-00.01,+25.01,+22.08,+0.4516,⌂3D,62,30/06/2009 14:07:08
06,01,-00.01,+00.00,-00.01,+25.01,+22.07,+0.4519,⌂3F,63,30/06/2009 14:07:08
01,02,-00.01,+00.01,+00.00,+25.02,+22.05,+0.4518,⌂3E,64,30/06/2009 14:07:08
02,B8,+00.00,+00.00,-00.01,+25.01,+22.02,+0.4512,⌂4E,65,30/06/2009 14:07:08
03,01,-00.01,+00.01,+00.00,+25.02,+22.06,+0.4525,⌂31,66,30/06/2009 14:07:08
```

Appendix F - Status Fields

There are a number of different status codes, which give the user information about various aspects of the anemometer. Each of these codes has an address field followed by a data field. The address field defines which particular aspect of the anemometer the following data field refers to. The address fields are defined as follows:

StaA - Status Address

Address	Function
00	Error codes
01	Anemometer configuration
02	Data output configuration 1
03	Data output configuration 2
04	Error code history
05	Transducer gain levels
06	Anemometer Type

In normal operation the anemometer output cycles through the status codes 01 - 06 at each output sample. If the anemometer detects an error then the status code 00 is displayed instead of the next cyclic status code. When the error is cleared, the status codes will continue to cycle from where they were interrupted.

If the error is caused by a transducer pair failure then the error code is displayed until the failure is rectified.

If the error is caused by a memory or PRT failure, then after 16 consecutive failed readings, the error condition is reduced to the error code history status and the error cleared.

The status data is output by the anemometer as a hex value, it needs to be converted to a binary number in order to determine the information provided. For example; a value of **h32** for status address **02** would mean that the anemometer is configured to output in polar 360 wrap, with a full scale deflection of ±10ms and with the SOS reporting sonic temperature in °C.

Example of Reported Transducer Fault on Axis 1:

00,01,,,-20.00,,00

Example of Reported Transducer Fault on all 3 Axes:
00,07,,,-20.00,,06

StaD - Status Data

Address 00 - Error codes

Bit	Function
0	Transducer pair 1 failed.
1	Transducer pair 2 failed
2	Transducer pair 3 failed
3	Reserved
4	Non-volatile memory error
5	PRT failed
6	Reserved
7	Reserved

Address 01 - Anemometer configuration

Bit	Function
0	Reserved
1	PRT fitted
2	Reserved
3	Reserved
4	0 U, V, W Axis definition (U aligned with transducer axis 1 when viewed from above)
	1 U', V', W' Axis definition (U' aligned with the spar)
5	Reserved
6	Reserved
7	Reserved

Address 02 - Data output configuration 1

Bits 1,0

00	Wind mode UVW
01	Wind mode axis
10	Polar 360 wrap
11	Polar 540 wrap

Bits 3,2

00	$\pm10\text{ms}^{-1}$ Full Scale Deflection
01	$\pm20\text{ms}^{-1}$ Full Scale Deflection
10	$\pm30\text{ms}^{-1}$ Full Scale Deflection
11	$\pm60\text{ms}^{-1}$ Full Scale Deflection

Bits 5,4

00	SOS report off
01	SOS report speed of sound
10	SOS report sonic temp. K
11	SOS report sonic temp. C

Bits 7,6

00	PRT temp. off
01	PRT temp. K
10	PRT temp. C
11	Reserved

Address 02 is repeated for 8 samples after a power on reset or exit from 'Interactive Mode' to allow the analogue output card or custom PC software to recognise the output configuration.

Address 03 - Data output configuration 2

Bits 2,1,0

000	No inputs enabled
001	1 input enabled
010	2 inputs enabled
011	3 inputs enabled
100	4 inputs enabled
101	5 inputs enabled
110	6 inputs enabled
111	Not used

Bit 3

0	Reserved
1	Reserved

Bits 5,4

00	Reserved
01	Reserved
10	Reserved
11	Reserved

Bits 7,6

00	Reserved
01	Reserved
10	Reserved
11	Reserved

Address 04 - Error code history

Bit	Function
0	Reserved
1	Reserved
2	Reserved
3	Reserved
4	Non-volatile memory error
5	PRT failed
6	Reserved
7	Reserved

The error history is cleared when the user enters interactive mode.

Address 05 - Transducer gain levels

Bits 1,0

00	Channel pair 1 nominal
01	Channel pair 1 @ 50%
10	Channel pair 1 @ 90%
11	Channel pair 1 @ 100%

Bits 3,2

00	Channel pair 2 nominal
01	Channel pair 2 @ 50%
10	Channel pair 2 @ 90%
11	Channel pair 2 @ 100%

Bits 5,4

00	Channel pair 3 nominal
01	Channel pair 3 @ 50%
10	Channel pair 3 @ 90%
11	Channel pair 3 @ 100%

Bits 7,6

Reserved

Address 06 - Anemometer type

Bits 2,1,0

|	
000	Single axis
001	Omnidirectional or Asymmetric
010	Three Axis Horizontal
011	Reserved
100	Reserved
101	Reserved
110	Reserved
111	Reserved

Bits 7,6,5,4,3 Not used.

Appendix G – Instructions for using Windconvert binary to ASCII conversion utility

▶

- WinConvert can be used with the Research & R3 range of Gill Anemometers to convert logged Binary data into a readable ASCII format.
- It is available to download from the Gill Instruments website:

 http://gillinstruments.com/main/software.html

 Once the program has downloaded and started, the following window will be displayed:
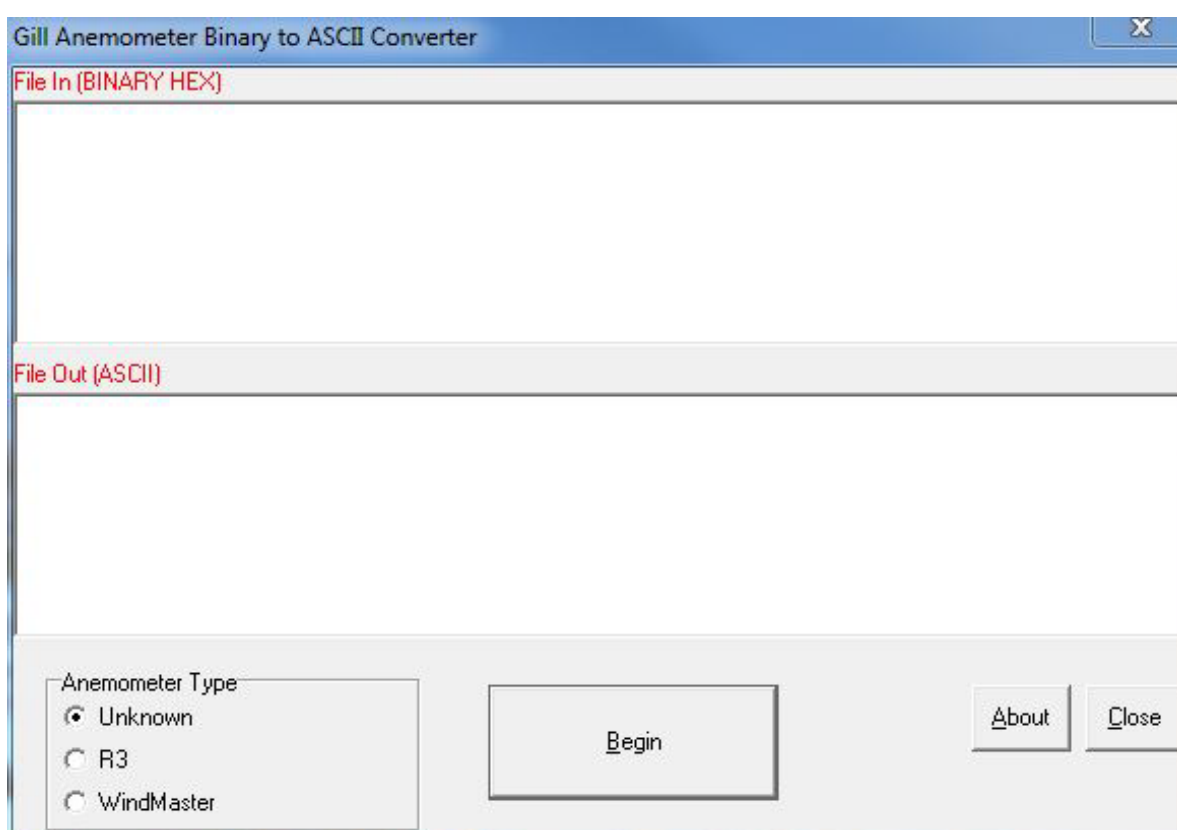
Select the type of anemometer the binary file was generated by (or leave unknown selected if the anemometer type is unknown), click begin to start the process and the following window will be displayed:
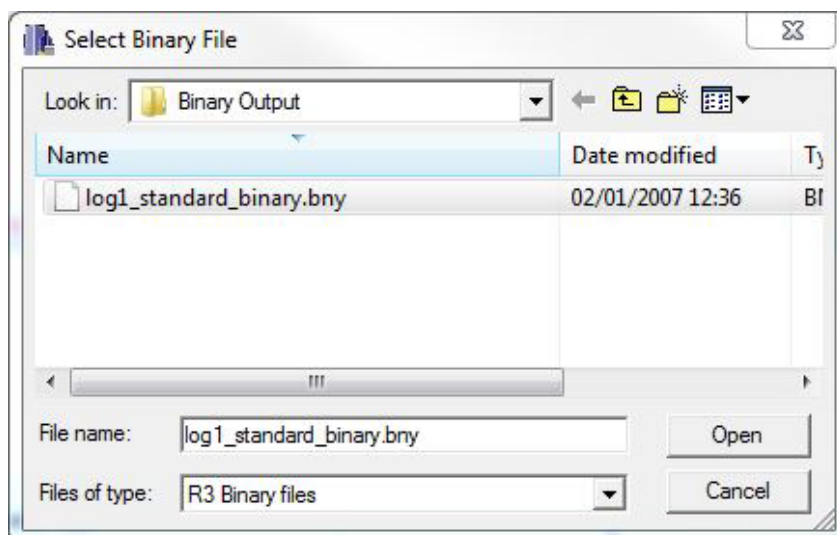
Select open and the conversion process begins, once complete the following message will be displayed:
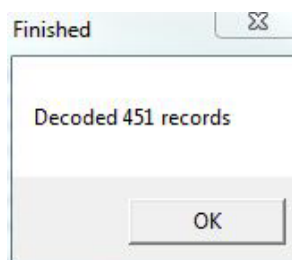
The results will be displayed in the main program lower window (together with the field information for the string.:
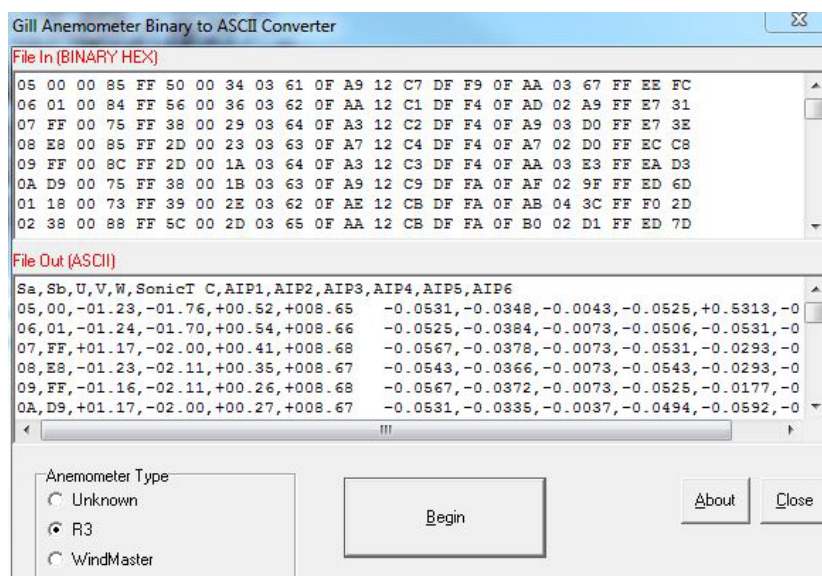
To save the data, select all the text in the lower window & copy it. Then open up a notepad/word package and paste the data. The file can then be saved.

Appendix H - Maintenance & Fault-Finding

Cleaning

If there is any build-up of deposit on the unit, it should be gently cleaned with a cloth moistened with water and soft detergent. Solvents should not be used, and care should be taken to avoid scratching any surfaces. The unit must be allowed to defrost naturally after being exposed to snow or icy conditions, do NOT attempt to remove ice or snow with a tool.

Do NOT attempt to remove ice or snow with a tool.

Servicing

There are no moving parts or user-serviceable parts requiring routine maintenance.
Opening the unit or breaking the security seal will void the warranty and the calibration.
In the event of failure, prior to returning the unit to your authorised Gill distributor, it is recommended that:

1. All cables and connectors are checked for continuity, bad contacts, corrosion etc.

2. A bench test is carried out as described in Appendix H

3. You contact your supplier for advice

Fault-finding

Symptom	Solution
No output	Check DC power to R3, cable and connections. Check comms settings of R3 (*as detailed in Section 14)* and host system match, including correct Com port. Check unit is in Continuous mode Check that in-line communication devices are wired correctly. It is usual for Anemometer TX to be connected to converter device RX
Corrupted output	Check Comms settings of R3 and host system match. Try using Gill Wind Software/Tools/Synch Comms Try a slower baud rate. Check cable lengths and type of cable.
One way communication	Check R3 and host system are both set to the same protocol RS232, RS422, or RS485. Check wiring is in accordance with the manual.
Failed / Incorrect R3 output, data invalid flag	Check that transducer path is not blocked

Appendix I - Tests

Bench Test

▶

1. Couple the R3 to the host system and power supply, using a known working test cable.

2. Check that the unit is correctly configured Appendix D

3. Check for normal output data, and that the Status Code is OK – 00.

4. If the status code is other than 00 or 0A, refer to Appendix F (error) codes.

5. Use an office fan or similar to check that the unit is sensing wind, turning the unit to simulate changing wind direction and to check that all three axes are functioning.

Head Alignment Test

▶

In ambient temperature conditions (+18°C to +26°C) and in a still air environment, it is possible to perform a check on the head alignment by using the Sonic Temperature reported by the R3 as an indicator. Using a PRT as a reference, compare the PRT reported value with the value being output by the R3. These values should be within ±3°C of each other within the temperature range specified above. If the Sonic Temperature reports outside of this tolerance range, the R3 has potentially suffered head distortion. If this is the case the R3 will need to be returned to Gill Instruments for investigation.

Calibration

⚠

There are no in-use calibration adjustments; the unit is designed NOT to require re-calibration within its lifetime.
Certified calibration
The R3 is Wind tunnel calibrated in accordance with ISO 16622 with traceability to national standards.

Accuracy at 12 m/s   Wind speed <1% RMS @ 12m/s   Direction <±1°RMS

Appendix J – Summary of Abbreviations Used in this manual

ASCII   American Standard Code for Information Interchange

PCIA   Power & Communications Interface with Analogue Outputs

PCI   Power & Communications Interface

SIU   Sensor Input Unit

PRT   Platinum Resistance Thermometer

RS232   Communications standard

RS422   Communications standard

SoS   Speed of Sound

Appendix K - Principle of Operation

TIME OF FLIGHT THEORY

$$T_2 = \frac{L}{C-V} \qquad \text{And} \qquad T_1 = \frac{L}{C+V}$$

Therefore

$$V = \frac{L}{2}\left\{\frac{1}{T_1} - \frac{1}{T_2}\right\} \qquad C = \frac{L}{2}\left\{\frac{1}{T_1} + \frac{1}{T_2}\right\}$$

KEY

L = Distance between transducer faces
C = Speed of sound
V = Velocity of gas flow
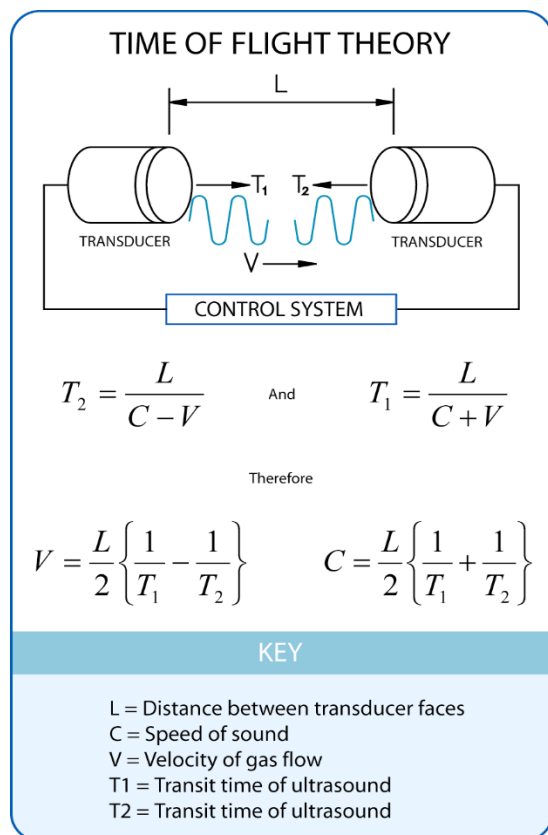T1 = Transit time of ultrasound
T2 = Transit time of ultrasound

Figure 20 Time of Flight details

Figure 1 and Figure 2 on page 8 show the direction and polarity of the U, V and W axes.

The wind speed in the UV plane, with direction in degrees from 0 to 359 °, with respect to the Reference spar (which is normally aligned to North)

The R3 measures the times taken for an ultrasonic pulse of sound to travel from an upper transducer to the opposite lower transducer, and compares it with the time for a pulse to travel from lower to upper transducer.

Likewise times are compared between each of the other upper and lower transducers.

As Figure 20 shows, the air velocity along the axis between each pair of transducers can then be calculated from the times of flight on each axis.

This calculation is independent of factors such as temperature.

From the three axis velocities, the wind speed is calculated, as either signed U, V, and W, or as Polar and W.

It can be seen from Figure 1 that the speed of sound in air can be calculated from the times of flight. From this the sonic temperature can be derived from the formula $T_{s1} = C_1{}^2 / 403$

Where

T_{s1} = Sonic temperature

C_1 = Speed of sound

⚠️

The above formula does not account for the effect of Humidity.

Crosswind correction is applied to results.