

Model 2040 Ultrasonic Wind Sensor



User's
Manual

Rev. G

<input checked="" type="checkbox"/>	FAA APPROVED ECP180 — 2011 May 5
<input type="checkbox"/>	NOT FAA APPROVED



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Latest Manual Version

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Foreword

Thank you for purchasing the Model 2040 manufactured by All Weather, Inc. The unit has no customer-serviceable parts and requires no calibration or maintenance. To achieve optimum performance we recommend that you read the whole of this manual before proceeding with use. Do **NOT** remove black “rubber” transducer caps.

AWI products are in continuous development and therefore specifications may be subject to change and design improvements without prior notice.

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1 Introduction

The AWI Model 2040 wind sensor is a very robust, lightweight unit with no moving parts, outputting wind speed and direction. The units of wind speed, output rate and formats are all user selectable.

The Model 2040 is available with or without de-icing heating (recommended if icing is likely), and with or without analog outputs.

The Model 2040 can be used in conjunction with a PC, datalogger or other device, provided it is compatible with the RS-422 output or the analog outputs. Multiple units can be networked if required.

Alternatively, the Model 2040 is designed to connect directly to the AWI WindDisplay unit to provide a complete wind speed direction system without any configuration required by the user.

The output message format can be configured in Polar, UV (2-axis), NMEA (0183 Version 3), Tunnel formats, and as either a Continuous output or Polled (requested by host system), detailed in full in ***Chapter 5, Message Formats & Options***.

Model 2040 may be configured using standard communications software on a PC. This is explained in ***Chapter 6, Configuring***.

2 Fast Track Setup

If you are in a hurry to try out the Model 2040, are familiar with AWI equipment, and coupling to a PC using RS-422, go to the following chapters.

Chapter 4 Installation

Chapter 5 Message Formats & Options

Chapter 6 Configuring

After you have successfully set up the Model 2040 Ultrasonic Wind Sensor, we strongly advise that you then go back and read the rest of the manual to ensure that you get the best results from the Model 2040 Ultrasonic Wind Sensor.

3 Pre-Installation

3.1 Equipment Supplied

- Model 2040 Option 1 RS-422 output
- or Model 2040 Option 2 RS-422 output and analog outputs
- or Model 2040 Option 3 RS-422 output and de-icing
- or Model 2040 Option 4 RS-422 output, analog outputs, and de-icing
- and Installation kit (comprising a gasket and four stainless steel screws)
- and Model 2040 Quick Start Guide
- and Model 2040 User Manual (this manual)
- and Integrity Check Chamber (ICC) (Optional)

3.2 Installation Requirements

Host system — One of the following:

- Ø PC with an internal or external interface compatible with the RS-422 output from the Model 2040.
- Ø Other equipment with I/O compatibility to the Model 2040 option selected.
For example, if the unit has Analog outputs, a Data Logger, Chart Recorder, or PC fitted with an ADC card.
- Ø Networking - Multiple Model 2040 units can be networked

Software — One of the following:

- Ø Hyperterminal (for Windows[®] 9x and later), or Terminal (Windows[®] 3.n), normally already installed on a PC.
- Ø Other Terminal Emulation software packages.

Cable and Junction Box

A 1.5 m or 10 m flying cable is supplied to connect the Model 2040 Ultrasonic Wind Sensor and the host system. A mast-mounted junction box (not provided) is required for onward connection.

See Section 4.4 for connection details

The flying cable must be retained with a cable tie within 150 mm of the base of the anemometer.

Mounting Bracket

A mounting bracket (not provided) is required to attach to the Model 2040 Ultrasonic Wind Sensor via the four tapped holes in the base of the unit. Always ensure that the gasket supplied is fitted to the base of the anemometer.

It is important that the gasket supplied forms a water-tight seal on the base of the anemometer.

In the event that the mounting bracket supplied by the customer is not flat or does not form complete support for the anemometer base, the customer must fit a mounting ring as shown in Figure 2.

See Section 4.6 for mounting details.

4 Installation

Do NOT remove the black “rubber” transducer caps. The warranty is voided if the blue security seal is damaged or removed.

All the time the Model 2040 Ultrasonic Wind Sensor is not in its final location, it should be protected from damage by keeping it in the original packaging as long as possible, treating it as a delicate instrument.

If an Intrinsically Safe (IS) device is required, the I.S. WindObserver must be used — the Model 2040 Ultrasonic Wind Sensor is NOT an IS device.

4.1 Installation Guidelines

The Model 2040 has been designed to meet and exceed the stringent standards listed in its specification. Operating in diverse environments all over the world, Model 2040 requires no calibration or adjustment whatsoever.

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

- Ø Always check the installation to ensure the Model 2040 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 —

- Ø Avoid mounting in the plane of any radar scanner — a vertical separation of at least 2 m should be achieved.
- Ø Radio transmitting antennas, the following minimum separations (all round) are suggested
 - VHF IMM – 1 m
 - MF/HF – 5 m
 - Satcom – 5 m (avoid likely lines of sight)
- Ø Ensure the product is correctly grounded in accordance with this manual
- Ø Use cables recommended by AWI, keeping the length below the maximum allowed (*see Section 4.3*) Where the cables are cut and re-connected (junction boxes, plugs and sockets) the cable screen integrity must be maintained, to prevent the EMC performance being compromised.
- Ø Ground loops should not be created – ground the system in accordance with the installation guidelines. (*see Section 4.4*)
- Ø Ensure the power supply operates to the Model 2040 Ultrasonic Wind Sensor specification at all times.

Avoid turbulence caused by surrounding structures that will effect the accuracy of the Model 2040 such as trees, masts and buildings. The World Meteorological Organisation make the following recommendation:

- Ø 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.

4.2 Bench System Test

Note : *Prior to physically mounting the Model 2040 in its final location, we strongly recommend that a bench system test is carried out to confirm the system is configured correctly, is fully functional and electrically compatible with the selected host system and cabling (preferably utilising the final cable length). The required data format, units, output rate, and other options should also all be configured at this stage. If an Integrity Check Chamber (ICC) has been purchased refer to Section 7.7 .*

4.3 Cabling

Cable Type

A RS-422 compatible cable should be used, with the number of twisted pairs matching the application. If both the (optional) Heating and Analog outputs are used, then a 9-pair cable is required.

Generic Description – Twisted pairs with drain wire, screened with aluminised tape, with an overall PVC sheath. Wire size 7/0.2 mm (24 AWG)

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

Table 1

No. of Pairs	AWI Ref.	Belden Ref.	Batt Electronics Ref.
2	—	9729	—
3	026-02660	9730	91030
4	026-03156	9728	91199
9	026-02663	8774	91009

Cable Length

The typical maximum length at 9600 baud is 1km (3200ft), using the recommended cable. If any problems of data corruption are experienced (due to, for example, a high local electrical 'noise' level), then a lower baud rate should be used. Alternatively, a thicker or higher specification cable can be tried. *See also Section 4.3 .*

Cabling and Junction Box

The Model 2040 unit is fitted with a flying 9 pair cable attached (1.5 m or 10 m long). This must be terminated in a suitable terminal box to IP66 or better, fitted with glands to prevent moisture ingress.

The cable type from the terminal box to the host system must be as specified above. If any cable is likely to be exposed to mechanical damage, it must be enclosed in a suitable conduit or cable tray. The cable must be securely fixed with cable clamps or equivalent, such that the cable is not under stress at the cable glands.

The gland area at the base of the Model 2040 **should not** be directly exposed to moisture, as whilst the gland is sealed when mated, the anemometer is vented to air at the base to avoid pressure build up. If an IP66 rating is essential or the unit is mounted other than 'right way up' **use the gasket** provided in the mounting kit.

4.4 Connections

Important

Do NOT join any of the cores of the cable together. Joining cores could damage the unit permanently. Any cores not used should be isolated.

Do NOT connect the unit's 0 V, Heater –, analog output 0 V, or digital 0 V to the screen or ground.

The screens of each pair are joined together inside the anemometer - these should be joined to the cable screen(s) of any further cable run. Avoid long grounding loops. Digital 0 V should be used in conjunction with RS-422 TX RX lines in order to improve noise immunity. Each pair in the cable is labelled with its pair number.

Table 2

Conductor	Color	Designation	
		Serial Numbers to 901001	Serial Numbers after 901001
Pair 1	green black	RS-422_TXB (+) RS-422_TXA (-)	RS-422_TXB (+) RS-422_TXA (-)
Pair 2	white black	RS-422_RXB (+) RS-422_RXA (-)	RS-422_RXB (+) RS-422_RXA (-)
Pair 3	red Black	Supply V+ Supply V-	Supply V+ Supply V-
Pair 4	blue black	Digital 0v Not used (isolate)	Digital 0v Analog 0v
Pair 5	yellow black	Heater+ * Heater- *	Heater+ * Heater- *
Pair 6	brown black	Analog Ch 1 voltage output * Analog Ch 1 current output *	Analog Ch 3 output * Analog 0v *
Pair 7	orange black	Analog Ch 2 voltage output * Analog Ch 2 current output *	Not used (isolate) * Not used (isolate) *
Pair 8	white red	Analog Ch 3 voltage output * Analog Ch 3 current output *	Analog Ch 1 output * Analog Ch 2 output *
Pair 9	green red	Analog 0 volt reference/current return * Analog 2.5 volt reference *	Not used (isolate) * Not used (isolate) *
Screens		Chassis ground	Chassis ground

* May not be functional - check model number and options fitted.

Grounding

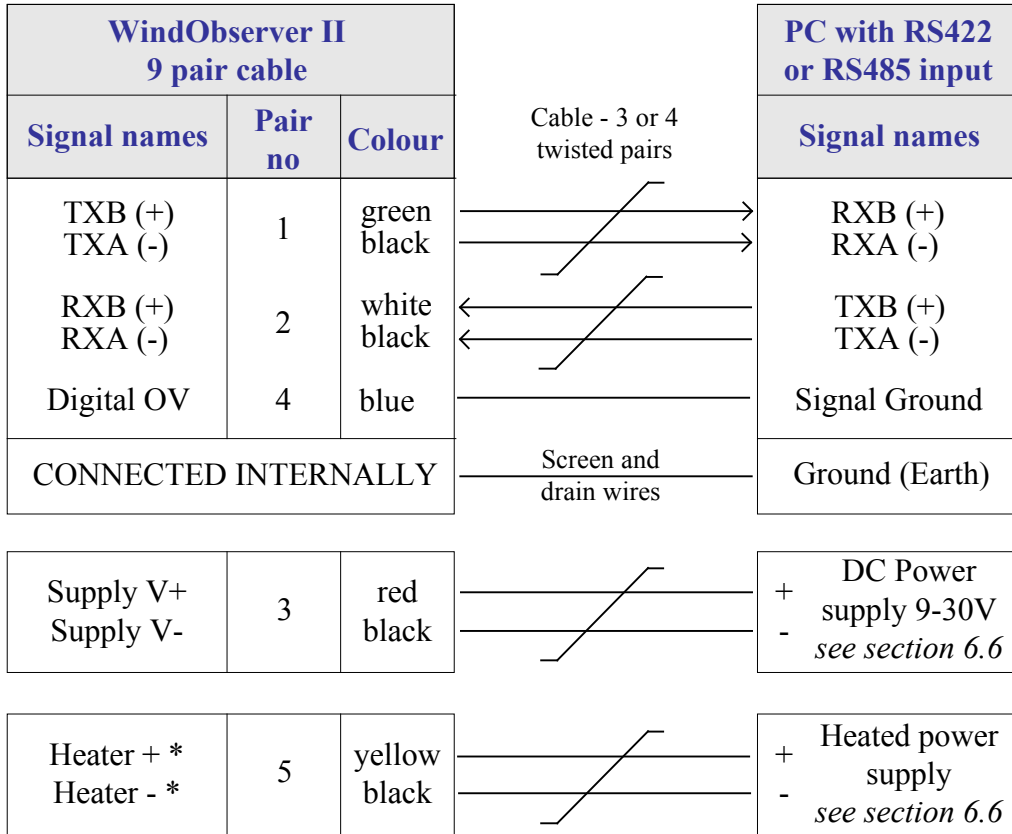
To ensure correct operation, and for maximum protection against lightning, the anemometer **MUST** be correctly grounded via its mountings. Inadequate grounding will degrade anemometer performance, particularly in the presence of radio frequency interference.

See Figure 1 Suggested Mounting Bracket and Grounding Arrangements

The unit **MUST** be connected to an appropriate grounding point with a minimum of 6mm² copper wire, via the M5 base screws. The cable screens must be joined with any cable screen continuing from the unit's cable via a junction box. The primary ground for the anemometer must be provided via the base screws and not via the cable screens.

Connecting to a PC with an RS-422 or RS-485 input

The PC requires either an internal RS-422 interface card or an external RS-422/485 to RS-232 converter that will plug into the standard 9-way or 25-way RS-232 serial port of the PC or host equipment.



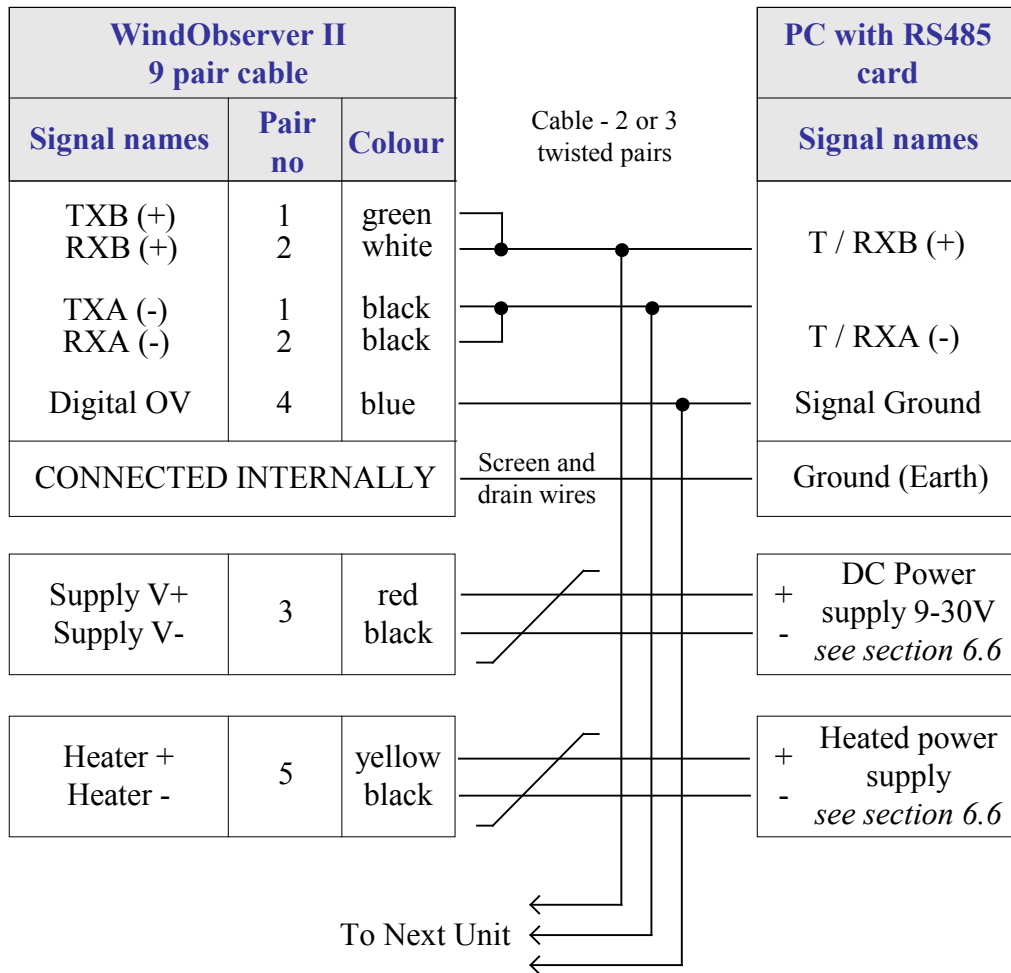
* If unit is fitted with a heater

Networking Units

Before coupling units into a network:

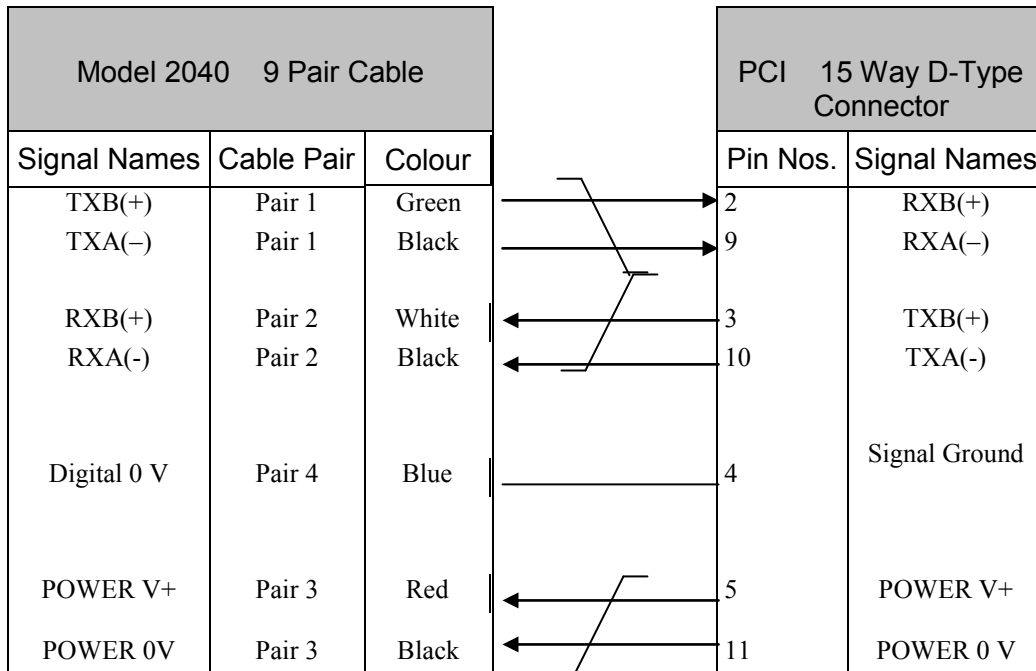
- Ø Each device must be configured with a unique Unit Identifier (letter B to Z)
- Ø It must be configured to a tri-state polled mode [M3](#) or [M4](#).

See Chapter 6 - Configuring



Note : Each unit in the network will require its own power supplies. Please refer to Section 5.3 .

Connecting to a PCI Unit with RS-422 Input



Indoor Power and Communications Interface (Part 1189-PK-021)

Environmental

The desktop PCI is intended for use in a protected environment and provides interfacing to a single anemometer. The PCI is not intended for outdoor use.

PCI Electrical Power Requirements

- 1) 100V AC – 120V AC, 10VA for the 115 V switch position
- 2) 200 V AC – 250V AC, 10VA for the 230 V switch position
- 3) 9–30V DC, 120 mA max (anemometer)
8–15V DC, 50 mA max (interface)

Three fuses protect the unit:

- | | |
|--------------------------|-----------------------------------|
| 1. Externally accessible | 315 mA(T) for 115/230 V operation |
| 2. Internally accessible | 500 mA (T) AUX |
| | 500 mA (T) ANEM |

PCI Connector Pin and Cable Assignments

Anemometer connector – 15 way

Pin	Designation
1	Chassis
2	RS-422_RXB (+)
3	RS-422_TXB (+)
4	Digital 0V, Signal ground
5	Supply V+
6	Analog output V1
7	Not used
8	Analog output V2
9	RS-422_RXA (-)
10	RS-422_TXA (-)
11	Supply V-
12	Analog output V4
13	Analog 0 V
14	Not used
15	Analog output V3

DC Supply – 4 way

Pin	Designation
1	Interface V+
2	Interface V-
3	Anemometer V-
4	Anemometer V+

RS-232 Output – 9 way

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

RS-422 Network In – 9 way Sockrt

Pin	Designation
1	Not connected
2	Not connected
3	Not connected
4	RS-422_RXA (-)
5	Signal ground
6	RS-422_TXA (-)
7	RS-422_TXB (+)
8	RS-422_RXB (+)
9	Chassis

RS-422 Network Out – 9 way Plug

Pin	Designation
1	Not connected
2	Not connected
3	Not connected
4	RS-422_RXA (-)
5	Signal ground
6	RS-422_TXA (-)
7	RS-422_TXB (+)
8	RS-422_RXB (+)
9	Chassis

4.5 Power Supplies

Sensor Power

Voltage	9 to 30 V DC
Current	60 mA max. 50 mA average

Heater

If included, the heating module requires a separate power supply.

Either

22 – 30 V DC @ 3 A

or 24 V AC rms \pm 10% @ 3 A AC r,s

NOTE: AC Supply must be isolated from Mains Supply

4.6 Mechanical Installation

Before installing, a bench system test is recommended (see Section 4.2).

All the time the Model 2040 is not in its final location, it should be protected from damage by keeping it in the original packaging as long as possible, treating it as a delicate instrument.

Location

It is important to ensure that the Model 2040 is mounted in a position clear of any structure which may obstruct the airflow or induce turbulence.

Do NOT mount the Model 2040 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. (See Section 4.1)

Orientation

Normally the Model 2040 Ultrasonic Wind Sensor is mounted vertically with the cable exit at the bottom.

Alternatively, the unit may be mounted in any orientation, but note that if the unit is mounted with the cable uppermost, the gasket provided in the mounting kit **must** be used.

Mounting Bracket

A suggested mounting bracket is shown in Figure 1 below.

It is recommended that the Model 2040 mounting bracket is manufactured from stainless steel 316, to prevent possible galvanic corrosion.

It is also recommended that the supplied gasket is always fitted to ensure IP66 rating and to prevent galvanic corrosion if the mounting bracket is not manufactured from stainless steel 316.

Stainless steel 316 fixings must be used.

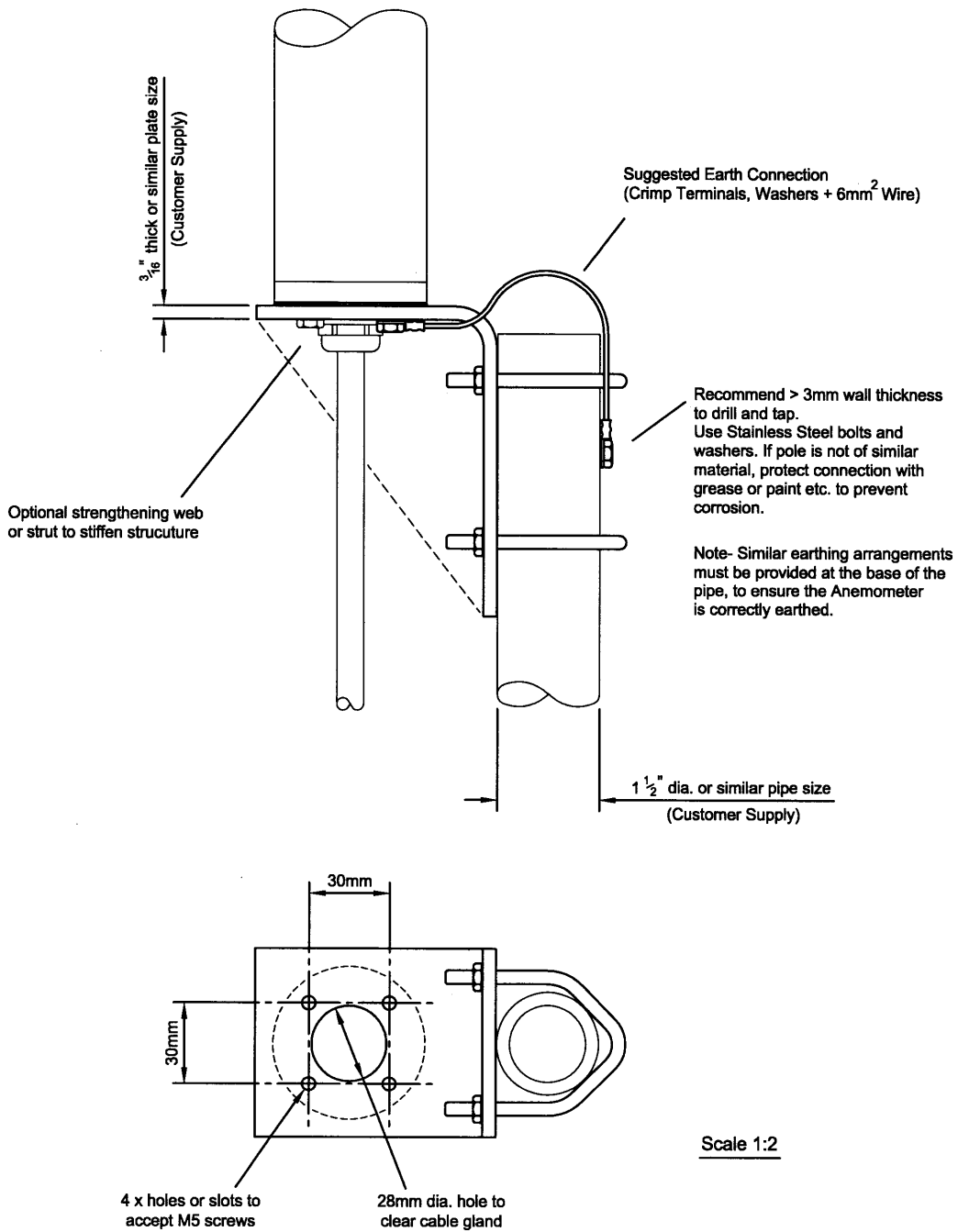
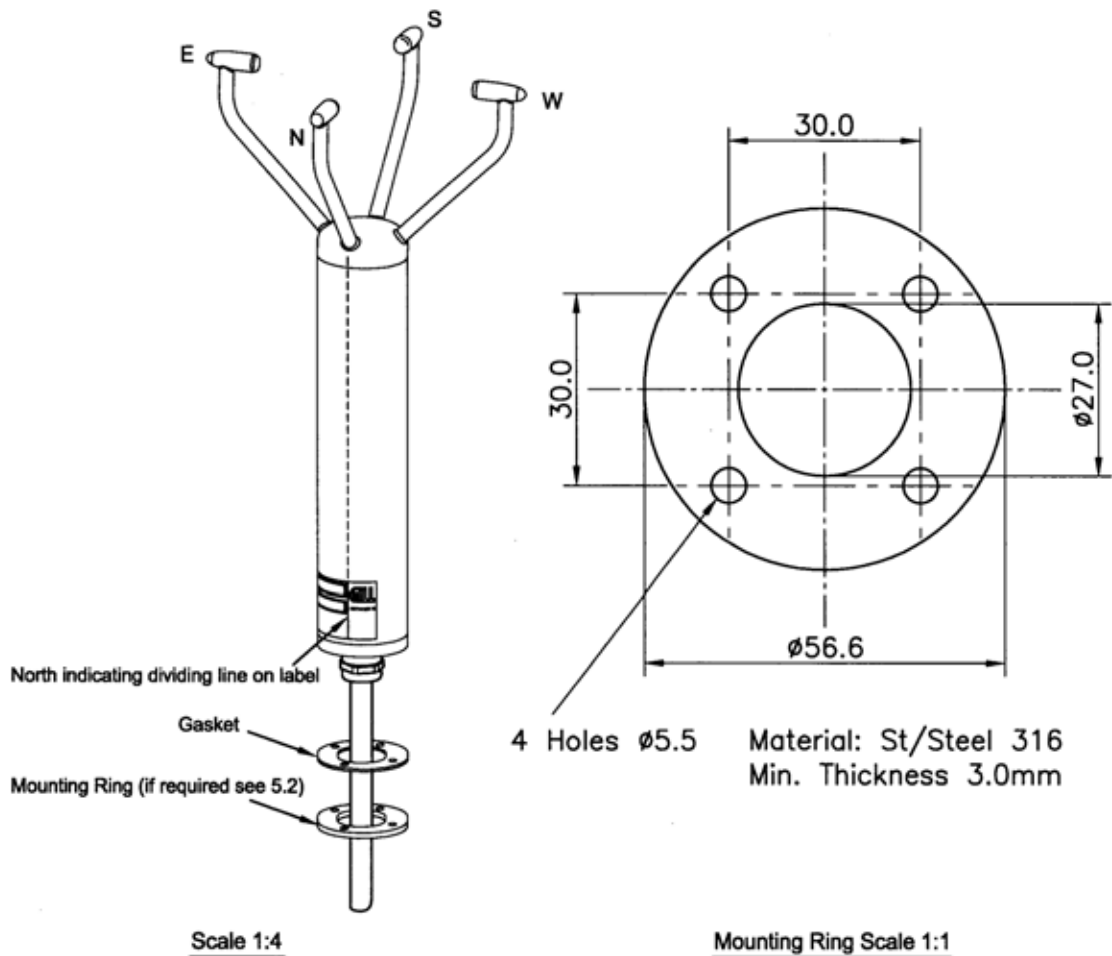


Figure 1. Suggested Mounting Bracket and Grounding Arrangements

Alignment

The anemometer should be set to point North (or to another known reference direction), using the North Spar, which can be identified from the alignment indicator on the base of the instrument. See Figure 1.

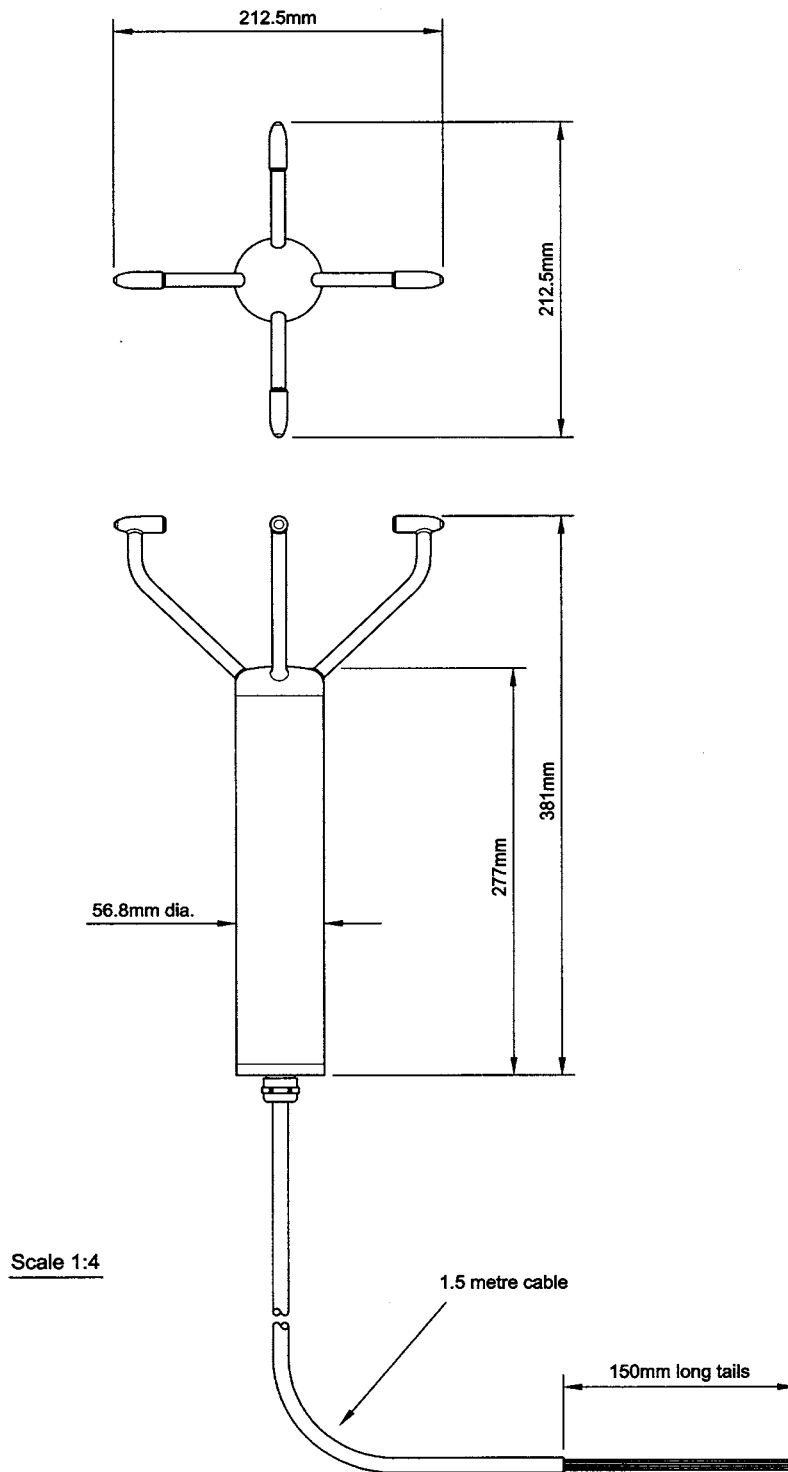
If the unit is used in a tunnel, (and the Tunnel format is used), the unit would normally be aligned with the N – S axis in the horizontal plane.



The North pointing spar of the unit is aligned with the dividing line between the silver and blue portions of the Gill Instruments Model and Serial No. label as shown above.

Figure 2. North Marker and UV Polarity Definition (UV format) and Mounting Ring

See Figure 4 for the definition of UV polarity.



Wind Observer II 2 Axis Anemometer Overall Dimensions

Figure 3. Model 2040 Ultrasonic Wind Sensor Outline Dimensions

5 Message Formats & Options

On first applying power to the Model 2040, it will be in 'Measurement Mode', and it will output wind measurement information in one of nine configurations as described below.

Setting the output format, units, other parameters, options and the communication settings are all carried out in the alternative 'Configuration Mode'.

See Chapter 6, Configuring, for details of how this is done.

The factory default settings are shown here in **bold**, and for convenience some 'Configuration codes' (as used to set the configuration) are shown in blue boxes, for example [M3](#).

5.1 Wind Speed Format

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

UV, Polar, Customer formats (NMEA and Tunnel).

5.2 Output Formats

The UV and Polar wind speed parameters are output in either ASCII or binary.

These parameters can be transmitted continuously or polled from the user.

Polar is also available in continuous NMEA format.

Table 3. Output Formats

Output Format		Output	Tri-state O/P	Configuration Code
ASCII	UV	Continuous	No	M1
		Polled	Yes	M3
ASCII	Polar	Continuous	No	M2
		Polled	Yes	M4
Binary	UV	Continuous	No	M7
Binary	Polar	Continuous	No	M8
Tunnel		Continuous	No	M6
NMEA		Continuous	No	M5

5.3 Networking

AWI Proprietary Network

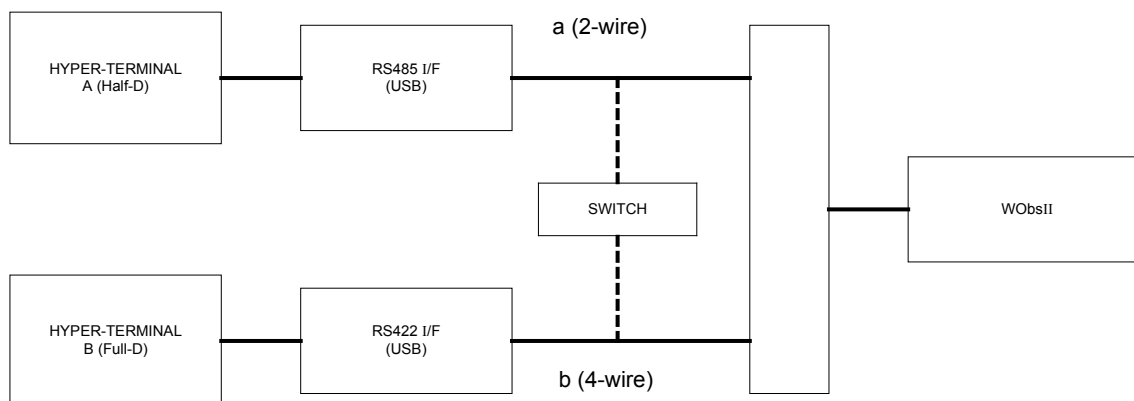
Each anemometer connected to the network **MUST** be given a unique Unit Identifier (Letters B to Z), and set to a polled tri-state mode (UV or Polar) ([M3](#) or [M4](#)).

In these modes the communications transmit line is tri-state unless the anemometer is responding to a command.

Configuring Model 2040 for Half-Duplex Operation

- 1) Set up two terminals—one for RS-485 Half Duplex and the other for RS-422 Full Duplex. One PC (with two USB ports) can be used for both terminals, although two may be less confusing.

Note: Power must not be disconnected from the anemometer throughout this procedure.



- 2) Assuming the unit is set for Full Duplex, connect 9-way at [b] disconnect 9-way at [a]. Set Switch to position [b] (4 wire).
- 3) On Terminal B, enter CONFIGURATION MODE. Set Half Duplex (E2). The CONFIRM> prompt will appear.
- 4) Disconnect 9-way [b] and connect 9-way [a]. Set Switch to position [a] (2 wire).
- 5) On Terminal A, type “E” <ENTER> to confirm.
- 6) The unit should now be configured in Half Duplex mode.

Configuring Model 2040 for Full Duplex Operation

- 1) Assuming the unit is set for Half Duplex, disconnect 9-way [b] and connect 9-way [a]. Set Switch to position [a] (2 wire).
- 2) On Terminal A, type “E1” to select Full Duplex. The CONFIRM> prompt will appear.
- 3) Disconnect 9-way [a] and connect 9-way [b]. Set Switch to position [b] (4 wire).
- 4) On Terminal B type “E” <ENTER> to confirm.

5.4 Units

The wind speed can be set to any of the following units:

Unit	Abbreviation
Metres per sec	m/s
Knots	knots
Miles per hour	MPH
Kilometres per hour	kph
feet per minute	fpm

5.5 Output Rate

The output frequency can be set between 1 and 10 per second. The wind speed is sampled every 25ms, each axis being sampled sequentially. The following Table lists the possible outputs per second and the corresponding number of averaged samples. A 25ms sample period is used to process and output the results.

Outputs per Second	Sample Average
1	39
2	19
4	9
5	7
8	4
10	3

5.6 Averaging

The Averaging Period can be set from zero to 3600 secs. (1 hour). The default setting is zero. When averaging is enabled, data is output at a rate determined by the averaging period. The data is an average of valid data collected during the averaging period.

5.7 Options

Speed of Sound (SOS) and Temperature

Either or both of these parameters can be selected or disabled

Note that neither of these parameters is available in Tunnel or NMEA formats.

SOS is useful for calculating air temperature with a rapid response. Sonic temperature is derived from the SOS, based on an assumption of the composition of the atmosphere. Humidity will affect the result.

True temperature can be calculated by:

$$T = \frac{T_s}{1 + 0.32(e/p)}$$

where

T = True temperature (Kelvin)

T_s = Sonic temperature

e = Vapour pressure of water in air

p = absolute pressure of water in air

Heating (If fitted)

Heating is autonomous and requires no set-up once activated.

45° Offset

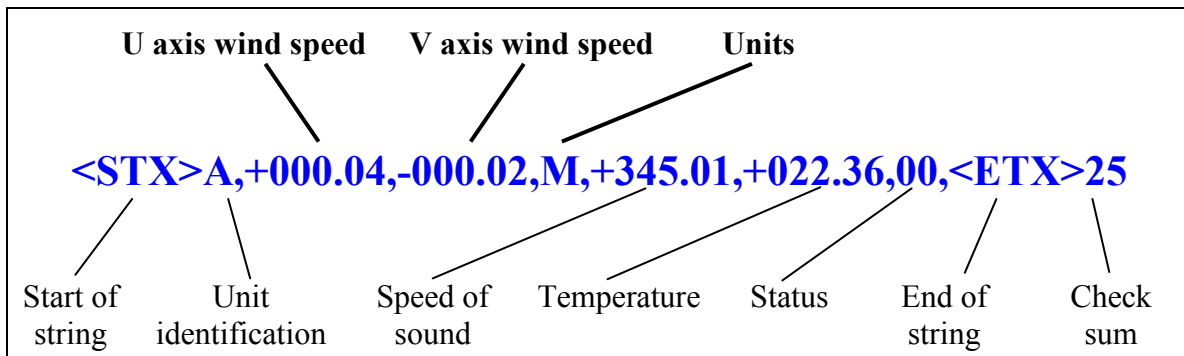
If required, the U axis can be offset +45° to the transducer axis.

Vertical Output Padding

A dummy W vector is inserted to provide compatibility with any WindMaster that may be in a network.

5.8 ASCII Message Format (UV and Polar)

ASCII UV Format



where

U axis wind speed In increments of 0.01 units (\pm UUU.UU)
V axis wind speed In increments of 0.01 units (\pm VVV.VV)

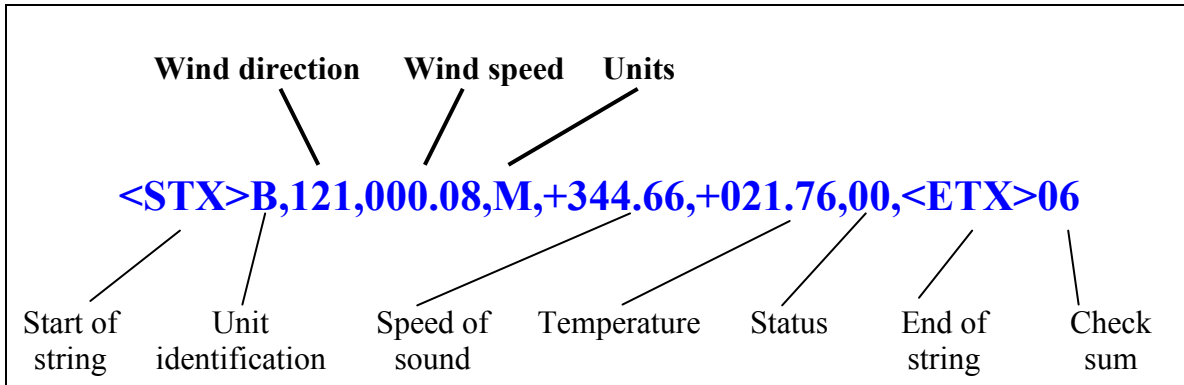
Units	Value	Units
	M	metres per second (m/s)
	N	knots (knots)
	P	miles per hour (MPH)
	K	kilometres per hour (kph)
	F	feet per minute (fpm)

Start of string ASCII value 2
Unit identification Letter A – Z (**default A**)
Speed of sound In metres per second (if enabled)
Temperature Sonic temperature in degrees C (if enabled)

Status	Value	Status
	0	OK
	60	HEATING ENABLED AND OK IF ENABLED
	Any other value	Warning or fault condition - see Section 7.6

End of string ASCII value 3
Check sum Exclusive OR of all characters between Start of String and End of String reported as ASCII hex.

ASCII Polar Format



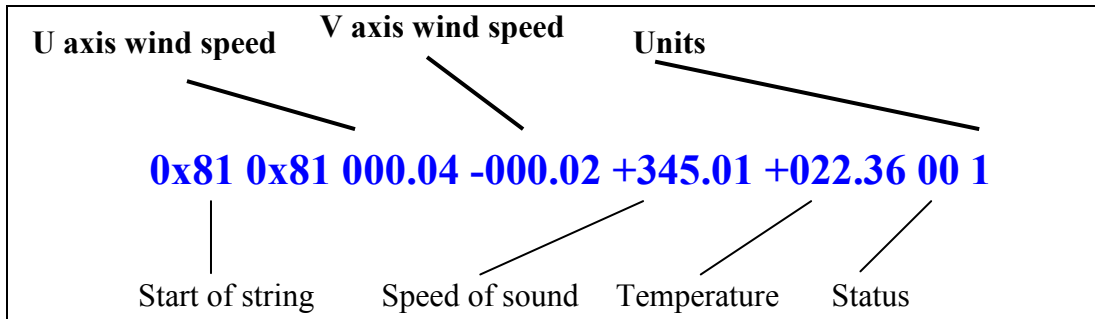
where

- Wind direction** In degrees relative to N (DDD)
- Wind speed** In increments of 0.01 units (\pm MMM.MM)

- All other parameters See Section 5.8 *ASCII UV format*

5.9 Binary Message Format (UV, Polar and Tunnel)

Binary UV Format



where

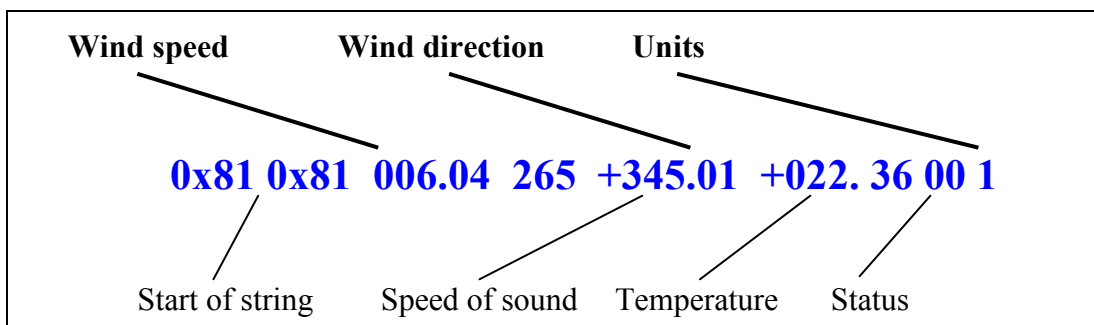
- U axis wind speed** In increments of 0.01 units (\pm UUU.UU)
- V axis wind speed** In increments of 0.01 units (\pm VVV.VV)

Units	Value	Units
	1	metres per second (m/s)
	2	knots (knots)
	3	miles per hour (MPH)
	4	kilometres per hour (kph)
	5	feet per minute (fpm)

Start of string
Speed of sound In metres per second (if enabled)
Temperature Sonic temperature in degrees C (two's complement signed) (if enabled)

Status	Value	Status
	0	OK
	60	Heating enabled and OK
	Any other value	Warning or fault condition - see Section 7.6

Binary Polar Format

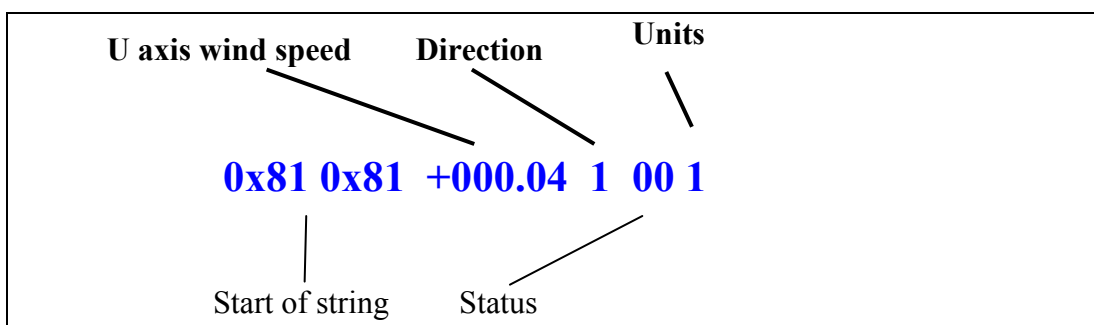


where

Wind direction In degrees relative to N (DDD)
Wind speed In increments of 0.01 units (\pm MMM.MM)

All other parameters See Section 5.9 *Binary UV format*

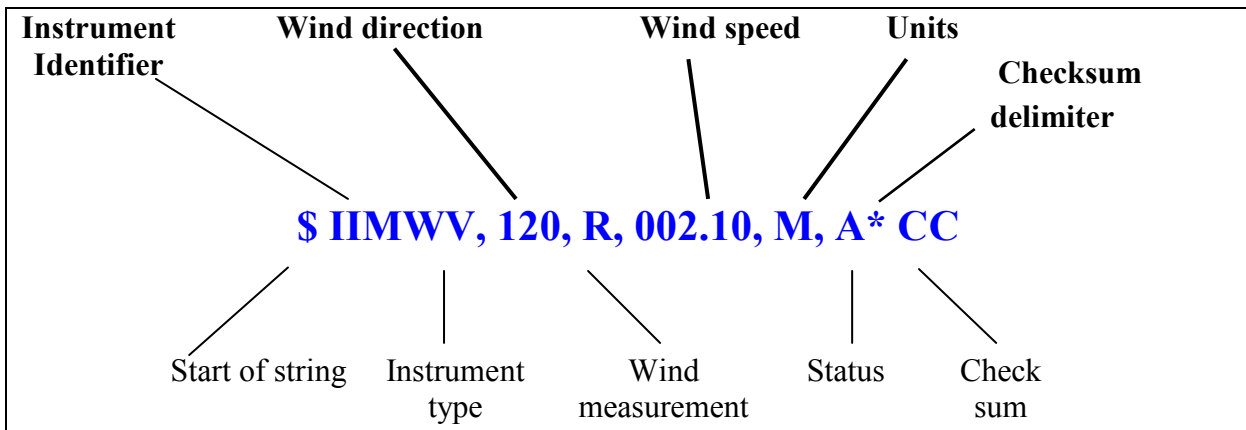
Binary Tunnel Format



U axis Wind speed In increments of 0.01 units (\pm MMM.MM)
Direction (along U axis) **Value** **Polarity**
 1 +U
 0 -U

Other parameters See Section 5.9 *Binary UV format*

5.10 NMEA Format



where

Wind direction	In degrees relative to N (DDD)		
Wind speed	In increments of 0.01 units (\pm MMM.MM)		
Units	M	metres per second (m/s)	
	N	knots (knots)	
	P	miles per hour (MPH)	
	K	kilometres per hour (kph)	
	F	feet per minute (fpm)	
Start of string	\$		
Instrument type	IIMWV		
Wind measurement	R	Relative wind measurement	
Status	A	Valid measurement	
	V	Invalid measurement	
Check sum	Exclusive OR of all characters between '\$' and '*' reported as ASCII hex.		

A typical Model 2040 Ultrasonic Wind Sesnor configuration suitable for NMEA would be:

B2, E1, F1, G0, K1, L1, M5, O1, P1, U1.

Consult specification NMEA 0183 version 3 (available on the web) www.nmea.org for complete interface details.

6 Configuring

Terminal emulator software such as Hyperterminal or Terminal is used to configure the Model 2040 Ultrasonic Wind Sensor.

The Model 2040 Ultrasonic Wind Sensor connects to an RS-422 to RS-232 adapter in the DCP. To perform the configuration described in this chapter, disconnect the serial DB-9 connector on that adapter and hook your laptop serial port to the adapter instead. Reconnect the serial DB-9 connector on that adapter once the configuration has been completed.

This section describes the commands used to change settings when using terminal emulator software. *For a fuller descriptions of the settings and options see Chapter 5, Message Formats & Options*

Keystrokes are shown thus :- `D 3 ENTER`

6.1 Entering Configuration Mode

From Continuous mode

`*`

From Polled mode

`* N` - where N is the Unit Identifier.

Note - the Unit Identifier must be entered as upper-case

The Model 2040 Ultrasonic Wind Sensor responds with a CONFIGURATION MODE message, stops reporting wind measurements, and waits for a command (as detailed below).

6.2 Returning to Measurement Mode

`Q ENTER`

If in **Continuous** mode, the anemometer responds with wind measurements immediately, continuing at the selected Sampling rate .

If in **Polled** mode,

- `?` Enables poll
- `N` Polls anemometer (where N is the Unit identifier entered as upper-case)
The anemometer replies with a single set of wind measurements
- `&` Anemometer replies with Unit identifier
- `!` Disables poll

Note:- If the unit is in Polled Mode it is always best to interrogate the unit for data with a `?` before the poll identifier to cater for the event that the power has been switched off or power interrupted.

6.3 Checking the Configuration

We strongly recommend that, as a standard procedure, you use this command (**D3**) prior to, and after, changing any settings. It shows the current settings for all the alterable settings. We suggest you note down your settings, so that you can easily return to them.

- *** Enters Configuration Mode (from Continuous mode)
- or ***N** Enters Configuration Mode (from Polled mode)
- D 3 ENTER** The Model 2040 responds with the current settings.

The AWI (All Weather, Inc.) factory default settings are

```
A0 B3 C1 E1 F1 G0000 H2 J1 K1 L1 M2 NA O2 P1 T1 U2 V1 X1 Y1 Z1
```

How to change these settings is explained in the following sections.

To return to Measurement mode **Q ENTER**

6.4 Changing Settings

To change a setting, first go into Configuration mode and then refer to the sections below. Enter the Configuration code of the new setting required, followed by **ENTER**. If successful, the new setting will be echoed back as a message by the Model 2040.

For example, to change the message format to NMEA, enter **M 5 ENTER**.

The Model 2040 will reply with **M5**. When the unit is returned to the Measurement mode, it will be in NMEA format.

Note : The factory-set (default) settings are shown in **bold** in the following sections.

6.5 Output Format

Output format	Configuration Code
ASCII UV Continuous	M1
ASCII UV Polled (tri-state) *	M3
ASCII Polar Continuous	M2
ASCII Polar Polled(tri-state) *	M4
Binary UV Continuous	M7
Binary Polar Continuous	M8
Tunnel Continuous	M6
NMEA Continuous	M5

* If units are to be networked, they MUST be given unique Unit Identifiers (see Section 6.6 Unit Identifier)

6.6 Unit Identifier

NX Changes the Unit Identifier to 'X'.
 'X' can be any letter from B to Z.

Note that the default Unit Identifier A should not be used when networking units.

6.7 Units

Units	metres/sec (m/s)	knots (knots)	miles / hour (MPH)	kilometres/hou r (kph)	feet/minute (fpm)
Configuration Code	U1	U2	U3	U4	U5

6.8 Output Rate

Outputs per second	1	2	4	5	8	10
Configuration Code	P1	P3	P2	P4	P5	P6

6.9 Averaging

Setting	Configuration Code
Averaging (Default)	G0000

Enter the required averaging period in seconds as a four figure number between 0000 and 3600.

6.10 Options

Speed of Sound (SOS) and Temperature

Setting	Configuration Code
Report SOS	A1
Report Sonic temperature	A2
Report SOS and Sonic temperature	A3
Disable both	A0

Note that neither of these parameters is available in Tunnel or NMEA formats.

Heating (If fitted)

Heating is autonomous and requires no set-up once activated.

Setting	Configuration Code
Disabled	H1
Activated	H2

Each transducer is heated independently and will be active when the ambient temperature drops below approximately +15°C; each transducer will de-activate when +25°C threshold is reached.

NMEA

Setting	Configuration Code
NMEA string “IIMWV”	K1
NMEA string “WIMWV”	K2

Vertical Output Padding

Setting	Configuration Code
Disable vertical output padding	V1
Enable vertical output padding	V2

45° Offset

Setting	Configuration Code	Notes
Align U axis with transducer axis	X1	X1. Aligns U axis with North/South axis.
Align U axis +45° to transducer axis	X2	X2. THIS RE-ALIGNS BOTH U&V AND POLARITY 45°.
Reverses Polar Direction	X3	X3 REVERSES REPORTED POLAR DIRECTION TO ALLOW THE INSTRUMENT TO BE MOUNTED UPSIDE DOWN. N.B. DOES NOT AFFECT UV ALIGNMENT (MODE 1, 3).
Align @ 45° from North	X4	X4 SET UV & POLAR ALIGNMENT AT 45 DEGREES FROM NORTH WHEN INSTRUMENT IS MOUNTED UPSIDE DOWN.

Figure 4 shows the polarity of U and V if the wind components along the U and V axis are blowing in the direction of the respective arrows.

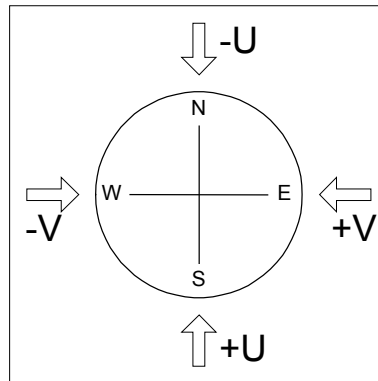


Figure 4. UV Polarity

6.11 Communications Settings

Baud Rate

Setting	Configuration Code
2400	B1
4800	B2
9600	B3
19200	B4
38400	B5
1200	B6
300	B7

If a request is sent to change the Baud rate, before it changes it must be confirmed by entering [B ENTER](#) (at the new Baud rate.)
 eg. If set to B3 (9600 baud), to change to B5 (38400 baud), enter [B 5 ENTER](#) , change host terminal to 38400 baud, and confirm by entering [B ENTER](#).

NOTE: a random echo will be generated after the B5 confirmation

Duplex Mode

Setting	Configuration code
Full duplex	E1
Half duplex	E2

Note:- Refer also to Para 8.3 Networking Configuration details.

Data and Parity Pptions

Setting	Configuration Code
8 bits, no parity, 1 stop bit	F1
8 bits, even parity, 1 stop bit	F2
8 bits, odd parity, 1 stop bit	F3
7 bits, no parity, 1 stop bit	F4
7 bits, even parity, 1 stop bit	F5
7 bits, odd parity, 1 stop bit	F6

ASCII Message Terminator

Setting	Configuration Code
CR LF	L1
LF	L2

6.12 Configuration and Diagnostic Information

Each of these commands causes a response from the Model 2040.

Item	Command Code	Typical Response
Type and serial No.	D1	E000694
Software version	D2	2.07
Unit configuration	D3	current configuration : A0 B3 C1 E1 F1 G0000 H1 J1 K1 L1 M2 NA O1 P1 T1 U1 V1 X1 Y1 Z1
Analog ID (if present)	D4	GI1390 fitted.
Anemometer power supply voltage	D5	+29.8
Integrity check	D6	

6.13 Message Format (Output String Padding)

Setting	Configuration Code
Comma Separated Variable (CSV)	O1
Fixed Field	O2

Example data string for CSV data changing to error status code condition.

A,235,000.77,M,00, 0A

A,,,M,04, 24

Example data string for Fixed Field data changing to error status code condition.

A,266,000.73,M,00, 08

A,999,999.99,M,04, 0A

6.14 New Unit Programming

If you order a replacement sensor, it should arrive programmed for your system. In the event your sensor loses its programming, follow the programming steps below to make the wind sensor work correctly.

1. Set terminal communications to 9600/8/N/1.
2. Output should show on screen each second.
3. Press "*" then "ENTER" (puts sensor in CONFIGURATION MODE).
4. Press "H2" (if heated version) then "ENTER" to enable the heater.
5. Press "U2" then "ENTER" to put sensor into knots output.
6. Press "O2" then "ENTER" to enable fixed format output.
7. Press "Q" then "ENTER" to exit configuration mode.
8. Sensor should now be outputting to the screen each second.

7 Maintenance & Troubleshooting

7.1 Cleaning

If there is any build up of deposit on the unit, it should be gently cleaned with a cloth, moistened with 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 remove black “rubber” transducer caps.

7.2 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 AWI, it is recommended that :

- Ø All cables and connectors are checked for continuity, bad contacts, corrosion etc.
- Ø A bench test is carried out as described in Section 7.7 .
- Ø You contact AWI for advice

7.3 AWOS Maintenance

Monthly Maintenance

No monthly maintenance is required with this sensor.

Quarterly Maintenance

During quarterly maintenance:

- Check that the wind values being output are reasonable
- Verify that no errors are displayed at the DCP

Annual Maintenance

During annual maintenance, perform a Field Zero Wind Check as described below.

Note: When performing this check, the current wind speed shown at the DCP must be 3 knots or less.

1. Ensure that the wind speed shown at the DCP is 3 knots or less.
2. Install the Integrity Check Chamber by inserting the reflector cases and the two halves of the ICC onto the Model 2040. The ICC must be retained using the strips provided.
3. View the wind speed value displayed at the DCP. The value must not exceed 0 knots. If wind speed exceeds 0 knots, contact All Weather, Inc.

7.4 Troubleshooting

Symptom	Solution
No output	<p>Check DC power to Model 2040, cable and connections.</p> <p>Check comms settings of Model 2040 (as detailed in Chapter 6) and host system match, including correct Com port</p> <p>Check unit is in Continuous mode</p> <p>Check that in-line communication devices are wired correctly.</p> <p>NOTE: It is usual for Anemometer TX + to be connected to converter device RX +</p>
Corrupted output	<p>Check comms settings of Model 2040 and host system match.</p> <p>Try a slower baud rate.</p> <p>Check cable lengths and type of cable.</p>
One way communication	<p>Check wiring is in accordance with the manual.</p>
Failed / Incorrect Model 2040 output, data invalid flag	<p>Check that transducer path is not blocked</p>

7.5 Returning Unit

If the unit has to be returned, it should be carefully packed in the original packaging and returned to AWI with a full description of the fault condition.

7.6 Status (Error) Codes

The Status code is sent as part of each wind measurement message.

Code	Status	Condition
00	OK	Sufficient samples in average period
60	OK and heating enabled	Sufficient samples in average period
A	OK	NMEA data valid
01	Axis 1 failed	Insufficient samples in average period on U axis
02	Axis 2 failed	Insufficient samples in average period on V axis
04	Axis 1 and 2 failed	Insufficient samples in average period on both axes
08	NVM error	NVM checksum failed
09	ROM error	ROM checksum failed
10	System gain at max.	Inaccurate results likely
50	Marginal system gain	Results OK, but marginal operation
51	Measurement average building	
62	Heating current tripped or electronic failure	
63	Thermistor open circuit	
65	Heating element open circuit	
V	NMEA data invalid	

7.7 Bench Test

Couple the Model 2040 to the host system and power supply, using a known working test cable. Check that the unit is correctly configured by going into Configuration mode and using [D3](#). See *Section 6.3 Checking the configuration*.

Check for normal output data, and that the Status Code is OK – 00, 60 or A (for NMEA format).

If the status code is other than these, refer to Section 7.6 Status (error) codes.

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 both axes are functioning.

Note that this a quick functional test. There are no calibration adjustments; the unit is designed NOT to require re-calibration within its lifetime. AWI has provided and Integrity Check, see next page for details.

Integrity Check Chamber (ICC)

The software to perform the Integrity Check (IC) is incorporated in the latest Model 2040's.

The IC is designed to:

1. Identify any gross changes in the head geometry that would affect the performance.
2. Provide a zero wind environment to confirm the Model 2040 zero calibration.

The ICC has been designed to be used in an indoor still air environment with an ambient temperature between 10°C and 28°C. When conducting the test it is important that the ICC is assembled on to the Model 2040 head and not touched or moved during the test.

This test is only valid if undertaken with an ICC purchased from AWI.

Integrity & Zero Wind Check

Zero Wind Check

Configure your PC to run HyperTerminal and assemble the ICC by inserting the reflector cases and the two halves of the ICC onto the Model 2040. The ICC must be retained using the strips provided. Then:

1. Ensure that the Model 2040 is set in factory default mode. For Factory default settings see Section 6.3 .
2. Enter Measurement Mode and Record/View data

In still air wind speed measurements should not exceed 0.03m/s. If wind speed exceeds 0.03m/s contact All Weather, Inc.

Integrity Check

Ensure the ICC is assembled correctly on the Model 2040. Using HyperTerminal, enter Configuration Mode as described in Section 6.1 .

Enter D6.

A typical report as shown below will be displayed.

```
ALIGNMENT LIMITS: U=2417,2517
                  V=2369,2469
ALIGNMENT U:2467 *PASS*
ALIGNMENT V:2419 *PASS*
GAIN 0:0007 *PASS*
GAIN 1: 0007 *PASS*
GAIN 2:0008 *PASS*
GAIN 3:0008 *PASS*
D6
```

If there has been no significant changes to The Model 2040 head configuration then *PASS* will confirm correct operation.

Alterations to the head geometry will result in a *FAIL* message. If this occurs please contact All Weather, Inc.

8 Specifications

Measurement

Output	1, 2, 4, 5, 8, 10 Hz
Parameters	UV, Polar, NMEA, Tunnel
Units	m/s, knots, MPH, KPH ft/min
Averaging	Flexible 1-3600 seconds

Wind Speed

Range	0 – 65 m/s (0–145 mph)
Accuracy	±2% @ 12 m/s
Resolution	0.01 m/s
Offset	±0.01 m/s

Direction

Range	0 – 359°
Accuracy	± 2°
Resolution	1°

Sonic Temperature Output

Range	-40°C to + 70°C
Anemometer Status	Supplied as part of standard message
Starting Threshold	0.01 m/s
Dead Band Wind Direction	None

Power Requirement

Anemometer Only	9–30 V DC (40 mA @ 12 V DC)
Heating - Optional	3 A @ 24 V AC or DC

Digital Output

Communication	RS-422, full duplex, network facility
Baud Rates	1200, 2400, 4800, 9600, 19200, 38400
Formats	8 data, odd, even or no parity

Analog Output - Optional

Quantity	3 (speed, direction, status or sonic temperature)
Scale	Multiples of ± 10 m/s up to ± 70 m/s
Type	± 2.5 V, 0–5 V or 4–20 mA
V output Resistance	60 Ω
4–20mA Loading	10–300 Ω

Dimensions

Size	405 mm × 210 mm
Weight	1.5 kg

Materials

External Construction	Stainless Steel 316
-----------------------------	---------------------

Environmental

Moisture Protection	IP66 (NEMA4X)
Operating temperature	-55°C to +70°C (heated version)
Humidity	5% to 100% RH
Precipitation	300 mm/hr
EMC	BS EN 50081-1: 1992 (Emissions class B) BS EN 50082-2: 1992 (Immunity) FCC Class A
Icing	MILSTD810E Method 521.1 Procedure 1
Standards	Traceable to UK national standards
Site Calibration	None required. (See Section 7.7 Zero Wind Check)

Appendices

A. Glossary & Abbreviations

Item	Meaning
CAL	Calibration
CR	Carriage Return
CRLF	Carriage Return Line Feed
CSV	Comma Separated Variable
ENG	Engineering
ESC	ESCAPE key on keyboard used to stop any process that is being executed
ETX	End of string character
FAC	Factory
fpm	Feet per minute
GND	GrouND
HEX	HEXadecimal
I/P	InPut
IP66	Protection Classification
KPH	Kilometres per Hour
LF	Line Feed
m/s	Metres per second
MAG	MAGNitude - scalar reference to wind speed
MAX	MAXimum
MPH	Miles per Hour
NEMA	National Electrical Manufacturers Association
NMEA 0183 (version 3)	National Marine Electronics Association standard for interfacing marine electronic navigational devices
No:	Number
NVM	Non-Volatile Memory
O/P	Output
PC	IBM compatible Personal Computer
PCB	Printed Circuit Board
POR	Power On Reset
PROCOMM	Terminal emulator software package
ROM	Read Only Memory
RS-232	Communications standard
RS-422	Communications standard
RS-485	Communications standard
RTS	Request to Send

Item	Meaning
RX	Receive
RXD	Received Data
S/W	Software
SOS	Speed Of Sound
SEC	SECOnd
STX	Start of string character
TERM	TERMIal
TX	Transmit
TXD	Transmitted Data
+VE	Positive
-VE	Negative
WRT	With Respect To

B. Warranty

Note: The warranty is void if the red security seal covering base nuts is damaged or broken, or the transducer caps have been damaged.

Unless specified otherwise, All Weather Inc. (the Company) warrants its products to be free from defects in material and workmanship under normal use and service for one year from date of shipment, subject to the following conditions:

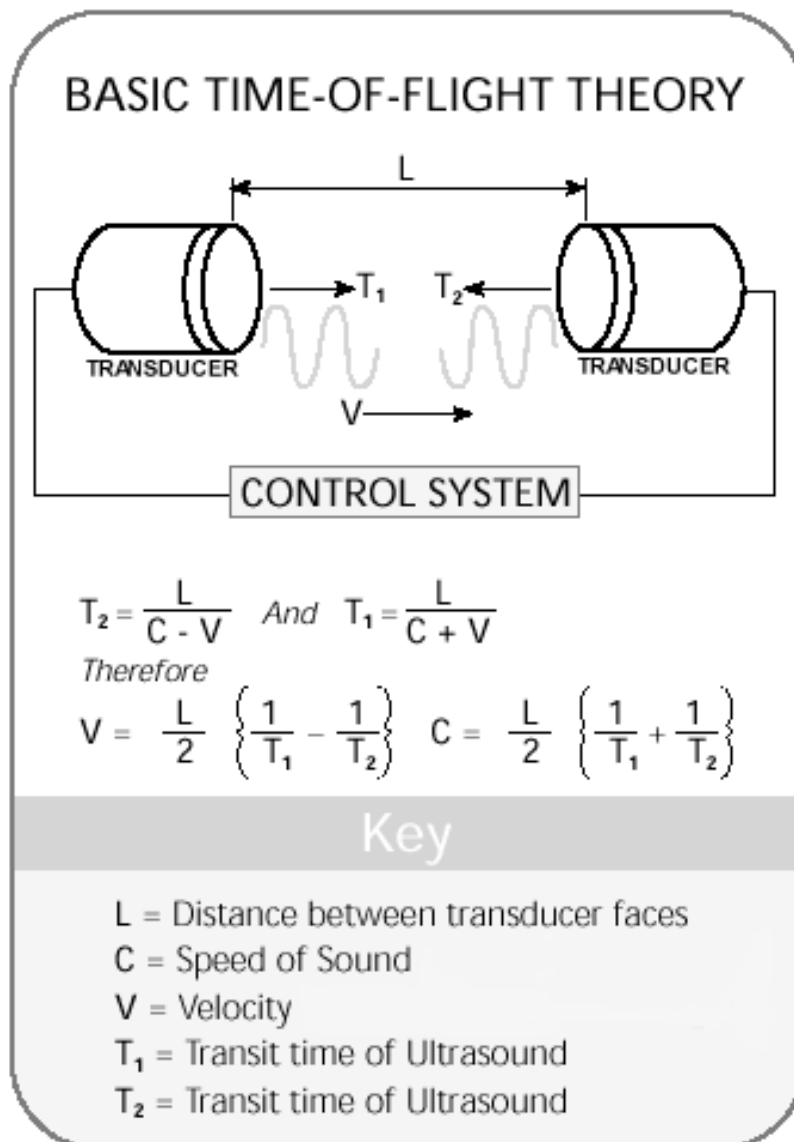
- a. The obligation of the Company under this warranty is limited to repairing or replacing items or parts which have been returned to the Company and which upon examination are disclosed, to the Company's satisfaction, to have been defective in material or workmanship at time of manufacture.
- b. The claimant shall pay the cost of shipping any part or instrument to the Company. If the Company determines the part to be defective in material or workmanship, the Company shall prepay the cost of shipping the repaired instrument to the claimant. Under no circumstances will the Company reimburse claimant for cost incurred in removing and/or reinstalling replacement parts.
- c. This warranty shall not apply to any Company products which have been subjected to misuse, negligence, or accident.
- d. This warranty and the Company's obligation thereunder is in lieu of all other warranties, express or implied, including warranties of merchantability and fitness for a particular purpose, consequential damages, and all other obligations or liabilities.

No other person or organization is authorized to give any other warranty or to assume any additional obligation on the Company's behalf, unless made in writing and signed by an authorized officer of the Company.

C. Principle of Operation

The Model 2040 Ultrasonic Wind Sensor measures the times taken for an ultrasonic pulse of sound to travel from the North transducer to the South transducer, and compares it with the time for a pulse to travel from S to N transducer. Likewise times are compared between West and East, and E and W transducer.

If, for example, a North wind is blowing, then the time taken for the pulse to travel from N to S will be faster than from S to N, whereas the W to E, and E to W times will be the same. The wind speed and direction (and the speed of sound) can then be calculated from the differences in the times of flight on each axis. This calculation is independent of factors such as temperature.





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2040-001
Revision G
May, 2010