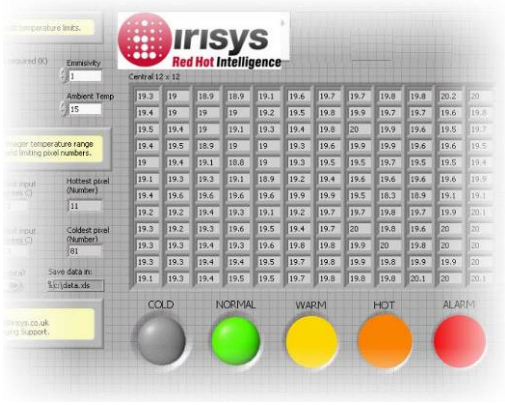
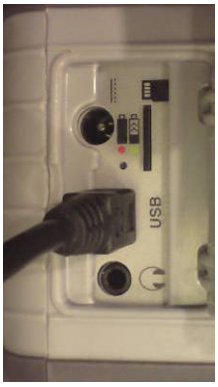
IRI 2012
USB Protocol





Safety Warning:
The equipment described in this document uses a Class 2 laser. Under no account should anyone look directly into the laser beam or the laser beam exit aperture, irreversible damage to the eye may occur. The laser should not be operated when there are personnel in the imager's field of view.
Caution – use of controls or adjustments or performance of procedures other than those specified in this document may result in hazardous laser radiation exposure.

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1. Introduction.

This document describes the protocol to access data over the USB interface for an IRI2000 series (specifically IRI2012) thermal imager. Please note that this does not provide any information on processing the thermal data received.

2. Setting up the thermal Imager and installing the Driver.

Note: For modules with no LCD screen, the camera will be set to 'USB data ON' at the factory.

i. Do not connect the Camera to the PC until instructed.
ii. Insert the CD with the drivers into the CD drive.
iii. Switch on the Camera.
    a) Select menu option by pressing Hotkey 4 on the Camera.
    b) Navigate to the Camera settings menu.
    c) Select USB data out and toggle it ON (This is a persistent setting).
iv. Connect the Camera and the PC using the USB cable.
v. On the PC screen you should see the message "Found New Hardware" and a request to load the driver. (See appendix 3 for more details)
vi. Select the option that allows you to load the Gserial Driver from the CD.
v. A new virtual com port will appear - to test the link you can connect to it using a terminal program - typing "ok" should elicit the response "ko". (See section 4 for more details).

3. Thermal Imager Commands.

Commands are sent as lower case words.

3.1 "help"

This prints help information for use when debugging with a terminal program.

3.2 "echo"

This command controls the way that characters sent to the imager are echoed back.

"echo" Toggles the character echo for use when debugging with a terminal program.

"echo 1" Turns character echo on.

"echo 0" Turns character echo off.

3.3 "thermal"

When the command "thermal" is sent to the imager, the imager will respond with the start sequence followed by 47x47 16 bit words of data (each sent as 2 bytes), and then the end sequence.

"ST" ... data (4418 bytes) ... "EN". (See appendix 2 for a full data set in HEX).

A total of 4422 bytes of data should be received from this command.

3.4 "ok"

This is a link check - "ko" will be returned.

4. Checking the Data Link and connection troubleshooting.

There are two checks that the IRI 2012 is transmitting data.

4.1. Use the IRISYS PC fever screening software. When you connect to the imager, the PC software shows a live thermal image. See Figure 1. This confirms that the IRI 2012 is transmitting data.

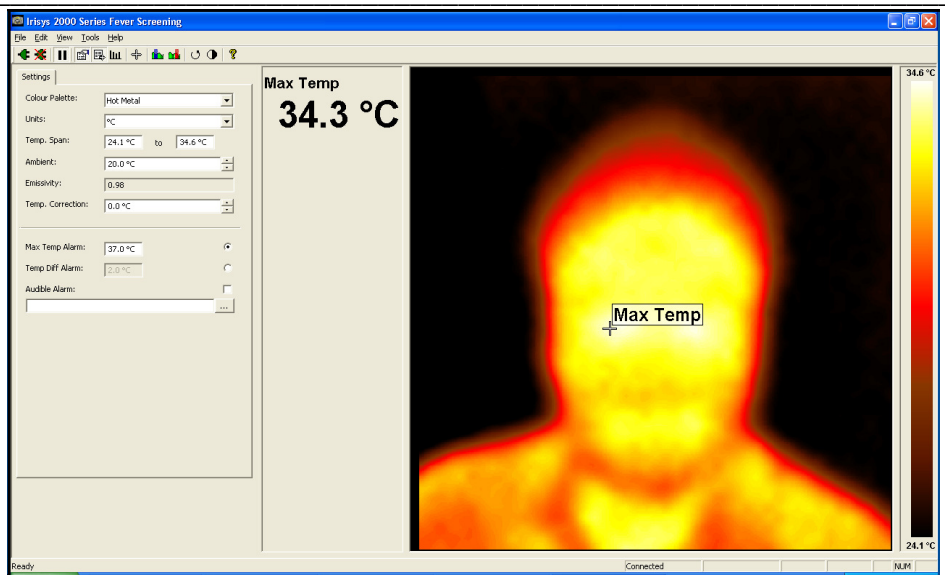


Figure 1. Screenshot of Fever screening PC software.

Troubleshooting for no data transmitted by the IRI 2012.

i. Disconnect all cables to the Camera and the PC.
ii. Restart the fever screening software.
iii. Switch off the Camera and then switch it on again. (Power cycle)
   a) Select menu option by pressing Hotkey 4.
   b) Navigate to the Camera settings menu.
   c) Select USB data out and toggle it ON.
iv. Connect the Camera and the PC using the USB cable.
v. Click on the connect camera icon, or select "connect to camera" in the tools menu.

If the above fails try the same sequence except for item iv. Connect to a different USB port on the PC.

4.2. Using a terminal emulation program to see the data format transmitted.
note: Hyper terminal has proved to be unsuitable with the IRI 2012.
The example shown below is using the Bray terminal program. This is available at (http://sites.google.com/site/braypp/terminal)

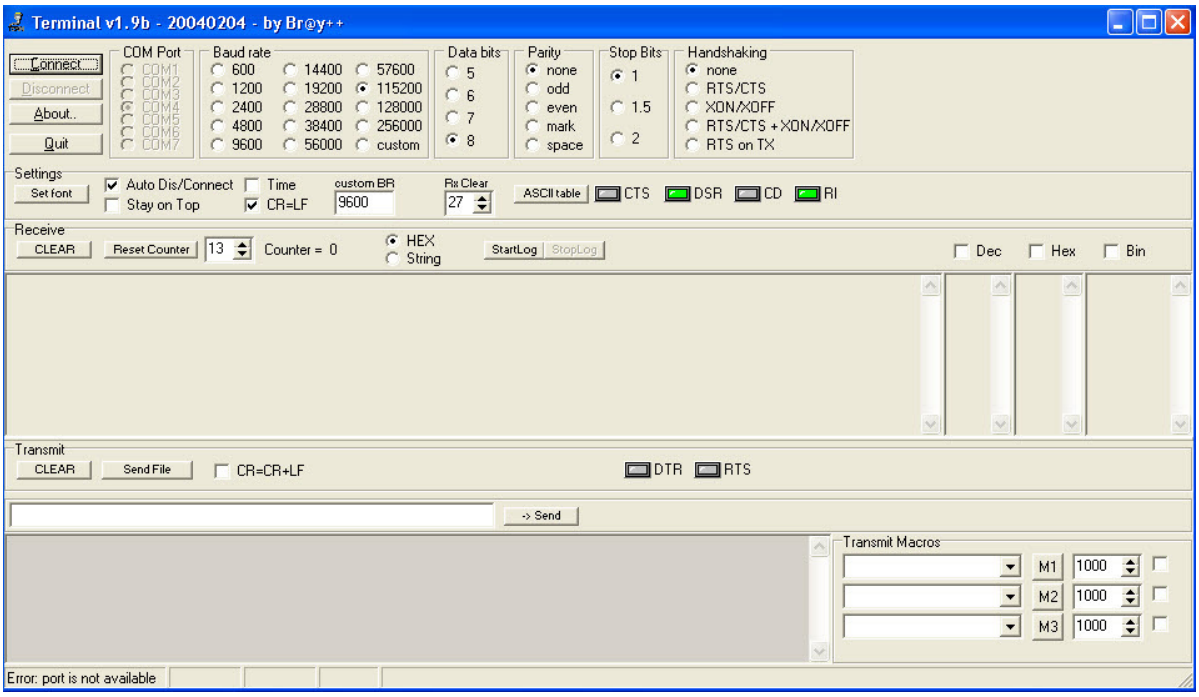


Figure 2. Screenshot of the Bray terminal program.

Settings used for the terminal program are:
Com port- selected; Baud rate – 115200; Data bits – 8;
Parity – none; Stop bits – 1; Handshaking – none;
CR-LF – selected.

On typing the command "thermal" the imager sends back data as shown below.

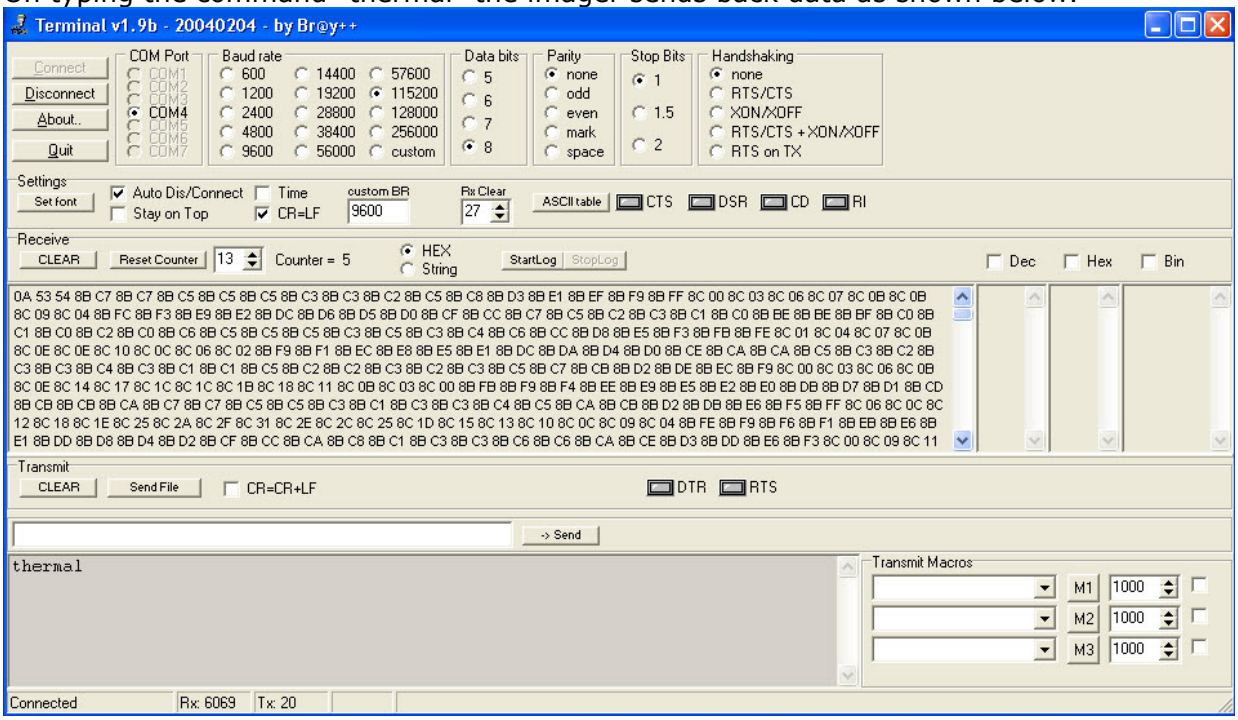


Figure 3. Screenshot showing data received from the IRI 2012.

Note: The terminal program is only used to establish that the imager is sending data.

5. Reading and interpreting the thermal Data

Summary: After sending the "thermal" command, look for the start sequence "ST". This will never happen in the data stream; once received, read in the correct amount of data, then the end sequence "EN", which again will not occur within the data stream.
Thermal data is sent from the camera as 2 byte words – 16 bits of which the lower 15 bits are unsigned temperature values (Kx10) and the top bit is always set. The byte order for the temperature data is: high byte, low byte. There is a total of 47 x 47 x 2 (4422) bytes of data sent. Read the data 2 bytes at a time and join into a 16 bit word, check that the top bit is set, if it isn't there is an error - restart the receive state machine and re-send the command. To decode the data, clear the top bit of the 16bit word, this then gives the temperature in Kelvin x 10. For example reading the two bytes 8B and 73 from the imager, combine to give the word 8B73 (hex); clearing the top bit gives 0B73 (hex); this has a decimal value of 2931. Therefore is 293.1K or 20.0°C.

Data is read in horizontal lines from the top left of the scene to the bottom right.

Note that each data set consists of two bytes.

5.1 Start of frame

The first two HEX bytes in the data set are 53 and 54. Combined this is 5354. The start of each frame of data is defined by "**ST**". In HEX "S"=53 and "T"=54. See Appendix 3 for a full HEX to ASCII conversion table. This combination does not occur anywhere else in the data set.

5.2. Temperature data values. 4418 bytes. (47x47 array and two bytes per pixel)

The temperature values for each pixel are extracted from the combination of two bytes using the procedure below.

a) Join the two bytes together.
b) Convert to the Binary equivalent.
c) Clear the first bit (Most significant bit).
d) Convert the remaining binary number to decimal.
e) Divide by 10 to get the Temperature value in Kelvin.

The table below shows an example of the above procedure, for the first 4 pixels from the data set in appendix 1.

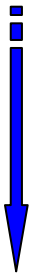
Two HEX Bytes	Binary Equivalent	Most Significant bit (1st bit) Cleared	Decimal equivalent	Temperature in Kelvin	Temperature in Centigrade
8B E1	1000101111100001	000101111100001	3041	304.1	11.0
8B E1	1000101111100001	000101111100001	3041	304.1	11.0
8B EB	1000101111101011	000101111101011	3051	305.1	12.0
8B F3	1000101111110011	000101111110011	3059	305.9	12.8

5.3. End of Frame

The last two HEX bytes in the data set are 45 and 4E. Combined this is 454E. The end of each frame of data is defined by "**EN**". In HEX "E"=45 and "N"=4E. See Appendix 3 for a full HEX to ASCII conversion table. This combination does not occur anywhere else in the data set.

5.4. Data Sequence

The data is read in horizontal lines from the top left of the scene to the bottom right as illustrated in the table below.

Line 1	1	2	3		46	47
Line 2	48	49				94
Line 3						
Line 46						2162
Line 47	2163					2209

Appendix 1 – Data for one Frame

The complete data transmitted for one frame in HEX is shown below.

53	**54**	8B	E1	8B	E1	8B	EB	8B	F3	8B	FD	8C	03	8C	09	8C	0E	8C	11	8C	16	8C	1B
8C	1E	8C	23	8C	27	8C	2C	8C	2E	8C	31	8C	34	8C	36	8C	38	8C	3A	8C	3B	8C	3C
8C	3C	8C	3C	8C	3B	8C	39	8C	3A	8C	38	8C	37	8C	36	8C	34	8C	30	8C	2D	8C	29
8C	25	8C	1F	8C	1A	8C	15	8C	10	8C	0B	8C	05	8B	FF	8B	FB	8B	F4	8B	EE	8B	E8
8B	E1	8B	ED	8B	F6	8B	FE	8C	05	8C	0B	8C	0E	8C	11	8C	14	8C	16	8C	1C	8C	21
8C	25	8C	29	8C	2B	8C	2F	8C	31	8C	34	8C	37	8C	3A	8C	3C	8C	3E	8C	41	8C	41
8C	42	8C	40	8C	3D	8C	3A	8C	39	8C	37	8C	34	8C	33	8C	31	8C	2D	8C	29	8C	28
8C	21	8C	1B	8C	16	8C	12	8C	0D	8C	0A	8C	07	8C	02	8B	FF	8B	F6	8B	F0	8B	EF
8B	F8	8C	01	8C	08	8C	0C	8C	0E	8C	11	8C	14	8C	14	8C	19	8C	1D	8C	21	8C	26
8C	2A	8C	2C	8C	2F	8C	30	8C	32	8C	39	8C	3C	8C	44	8C	49	8C	4B	8C	4B	8C	4B
8C	49	8C	45	8C	40	8C	3B	8C	39	8C	34	8C	32	8C	30	8C	2F	8C	2C	8C	29	8C	22
8C	1F	8C	19	8C	16	8C	12	8C	0E	8C	0C	8C	08	8C	04	8C	01	8B	FC	8B	FA	8C	02
8C	08	8C	0D	8C	0F	8C	12	8C	14	8C	15	8C	18	8C	1C	8C	1F	8C	23	8C	27	8C	28
8C	2A	8C	2C	8C	2E	8C	32	8C	3B	8C	45	8C	4E	8C	56	8C	59	8C	5C	8C	5B	8C	58
8C	4F	8C	49	8C	41	8C	3A	8C	31	8C	30	8C	2E	8C	2E	8C	2F	8C	28	8C	24	8C	1F
8C	1D	8C	17	8C	15	8C	11	8C	11	8C	0D	8C	0B	8C	06	8C	02	8C	05	8C	09	8C	0C
8C	10	8C	12	8C	14	8C	16	8C	17	8C	1B	8C	1E	8C	20	8C	23	8C	26	8C	25	8C	28
8C	27	8C	2A	8C	32	8C	3D	8C	4F	8C	5D	8C	65	8C	6D	8C	6E	8C	6D	8C	68	8C	5F
8C	54	8C	48	8C	3D	8C	31	8C	2A	8C	29	8C	2C	8C	2B	8C	2C	8C	25	8C	21	8C	1D
8C	1A	8C	18	8C	14	8C	13	8C	10	8C	0E	8C	0B	8C	07	8C	0D	8C	0D	8C	0F	8C	12
8C	15	8C	17	8C	18	8C	1B	8C	1C	8C	20	8C	21	8C	23	8C	25	8C	22	8C	22	8C	21
8C	25	8C	30	8C	45	8C	5A	8C	6D	8C	7A	8C	80	8C	81	8C	81	8C	7C	8C	70	8C	64
8C	55	8C	42	8C	32	8C	25	8C	24	8C	26	8C	2A	8C	29	8C	27	8C	21	8C	1F	8C	19
8C	19	8C	17	8C	14	8C	10	8C	11	8C	0C	8C	09	8C	0E	8C	0F	8C	11	8C	14	8C	15
8C	18	8C	19	8C	1C	8C	1E	8C	1F	8C	20	8C	20	8C	20	8C	1E	8C	1B	8C	1A	8C	22
8C	33	8C	4C	8C	6A	8C	80	8C	8E	8C	95	8C	97	8C	97	8C	91	8C	85	8C	76	8C	63
8C	4D	8C	35	8C	25	8C	21	8C	21	8C	27	8C	27	8C	25	8C	24	8C	20	8C	1C	8C	1B
8C	15	8C	15	8C	12	8C	11	8C	0F	8C	0B	8C	0F	8C	10	8C	11	8C	14	8C	17	8C	18
8C	1A	8C	1C	8C	1E	8C	21	8C	21	8C	21	8C	1C	8C	1B	8C	17	8C	18	8C	21	8C	3A
8C	5B	8C	7F	8C	98	8C	AA	8C	B5	8C	B8	8C	B6	8C	B0	8C	A2	8C	90	8C	77	8C	5B
8C	41	8C	28	8C	1E	8C	1E	8C	22	8C	25	8C	24	8C	24	8C	21	8C	1E	8C	1B	8C	19
8C	15	8C	14	8C	11	8C	0D	8C	0D	8C	11	8C	12	8C	13	8C	15	8C	17	8C	1A	8C	1A
8C	1C	8C	1E	8C	20	8C	20	8C	1E	8C	1B	8C	15	8C	13	8C	18	8C	28	8C	48	8C	72
8C	9C	8C	BB	8C	D0	8C	DC	8C	E3	8C	E1	8C	D8	8C	CB	8C	B6	8C	96	8C	74	8C	4F
8C	34	8C	23	8C	1D	8C	20	8C	23	8C	23	8C	24	8C	23	8C	21	8C	1E	8C	1A	8C	17
8C	13	8C	13	8C	0E	8C	0C	8C	12	8C	13	8C	14	8C	15	8C	17	8C	1A	8C	1C	8C	1D
8C	1E	8C	21	8C	1F	8C	1B	8C	18	8C	13	8C	13	8C	1C	8C	36	8C	5E	8C	8F	8C	C0
8C	E5	8C	FC	8D	0B	8D	13	8D	10	8D	09	8C	F8	8C	E1	8C	C1	8C	97	8C	6B	8C	43
8C	2A	8C	1D	8C	1E	8C	21	8C	22	8C	24	8C	24	8C	22	8C	1E	8C	1B	8C	19	8C	16
8C	13	8C	11	8C	0D	8C	12	8C	13	8C	15	8C	16	8C	1A	8C	1C	8C	1D	8C	1E	8C	1F
8C	20	8C	1E	8C	1A	8C	17	8C	14	8C	19	8C	2A	8C	4B	8C	7D	8C	B5	8C	E9	8D	11
8D	2A	8D	38	8D	40	8D	42	8D	38	8D	29	8D	0F	8C	EC	8C	C2	8C	8F	8C	5C	8C	35
8C	22	8C	1B	8C	1D	8C	21	8C	24	8C	24	8C	22	8C	21	8C	1D	8C	19	8C	18	8C	14
8C	0F	8C	0E	8C	13	8C	14	8C	17	8C	18	8C	19	8C	1C	8C	1E	8C	1E	8C	21	8C	21
8C	1F	8C	1B	8C	1A	8C	1A	8C	25	8C	40	8C	68	8C	A0	8C	DD	8D	11	8D	38	8D	51
8D	60	8D	69	8D	6A	8D	62	8D	53	8D	39	8D	15	8C	E8	8C	B2	8C	7C	8C	49	8C	2B
8C	1E	8C	1E	8C	1F	8C	24	8C	24	8C	23	8C	21	8C	20	8C	1A	8C	19	8C	15	8C	13
8C	0F	8C	14	8C	17	8C	16	8C	18	8C	1A	8C	1C	8C	1D	8C	1F	8C	20	8C	21	8C	20
8C	1D	8C	20	8C	28	8C	3D	8C	5E	8C	8D	8C	C5	8D	00	8D	35	8D	58	8D	6E	8D	78
8D	7F	8D	80	8D	7A	8D	70	8D	58	8D	37	8D	0D	8C	D6	8C	9C	8C	67	8C	3E	8C	26
8C	22	8C	23	8C	26	8C	25	8C	24	8C	21	8C	1F	8C	1E	8C	19	8C	18	8C	13	8C	11
8C	14	8C	18	8C	16	8C	19	8C	1C	8C	1E	8C	20	8C	20	8C	21	8C	22	8C	23	8C	25
8C	2D	8C	3E	8C	59	8C	83	8C	B4	8C	EA	8D	20	8D	4D	8D	6B	8D	7A	8D	80	8D	83
8D	85	8D	81	8D	7A	8D	6B	8D	51	8D	2A	8C	F8	8C	BE	8C	8A	8C	5B	8C	3C	8C	2E
8C	28	8C	26	8C	26	8C	24	8C	24	8C	21	8C	1E	8C	1B	8C	18	8C	14	8C	12	8C	15
8C	17	8C	17	8C	19	8C	1C	8C	1D	8C	20	8C	21	8C	22	8C	24	8C	29	8C	31	8C	40
8C	5B	8C	7D	8C	A8	8C	D8	8D	08	8D	34	8D	59	8D	6D	8D	75	8D	79	8D	7A	8D	7C
8D	7A	8D	78	8D	71	8D	60	8D	40	8D	12	8C	DF	8C	AC	8C	7F	8C	5A	8C	42	8C	30
8C	2B	8C	28	8C	28	8C	25	8C	21	8C	1F	8C	1B	8C	19	8C	16	8C	13	8C	15	8C	16
8C	19	8C	1B	8C	1C	8C	1F	8C	21	8C	20	8C	24	8C	28	8C	31	8C	42	8C	5B	8C	7C
8C	A0	8C	CB	8C	F7	8D	20	8D	43	8D	5C	8D	64	8D	66	8D	67	8D	69	8D	6A	8D	6C
8D	6E	8D	6B	8D	61	8D	4C	8D	29	8C	FC	8C	CF	8C	A2	8C	7A	8C	58	8C	41	8C	34
8C	2D	8C	29	8C	26	8C	22	8C	20	8C	1F	8C	19	8C	18	8C	14	8C	17	8C	18	8C	19
8C	1A	8C	1E	8C	1F	8C	20	8C	23	8C	26	8C	2E	8C	3D	8C	56	8C	77	8C	9B	8C	C3
8C	EB	8D	12	8D	32	8D	49	8D	53	8D	55	8D	55	8D	55	8D	54	8D	58	8D	5A	8D	5E
8D	5F	8D	5C	8D	4F	8D	38	8D	16	8C	EE	8C	C3	8C	9A	8C	74	8C	51	8C	3C	8C	2F
8C	2A	8C	27	8C	25	8C	22	8C	1E	8C	1B	8C	19	8C	16	8C	15	8C	19	8C	19	8C	1B
8C	1E	8C	20	8C	22	8C	24	8C	29	8C	38	8C	4B	8C	6D	8C	91	8C	BA	8C	E1	8D	08
8D	26	8D	3D	8D	46	8D	47	8D	45	8D	44	8D	44	8D	46	8D	49	8D	4C	8D	50	8D	53
8D	55	8D	4F	8D	40	8D	29	8D	08	8C	E1	8C	B9	8C	8E	8C	69	8C	48	8C	35	8C	2C
8C	29	8C	26	8C	23	8C	1F	8C	1C	8C	19	8C	16	8C	17	8C	1A	8C	1B	8C	1D	8C	1E
8C	20	8C	22	8C	25	8C	2D	8C	40	8C	59	8C	7F	8C	A8	8C	D4	8C	FA	8D	1B	8D	31
8D	3D	8D	3E	8D	3C	8D	38	8D	36	8D	36	8D	39	8D	3D	8D	42	8D	45	8D	46	8D	49
8D	49	8D	42	8D	34	8D	19	8C	F8	8C	D0	8C	A5	8C	7D	8C	57	8C	3C	8C	2F	8C	29
8C	27	8C	24	8C	20	8C	1D	8C	1A	8C	17	8C	18	8C	19	8C	1C	8C	1D	8C	1F	8C	21
8C	24	8C	29	8C	33	8C	48	8C	69	8C	90	8C	BD	8C	E8	8D	0D	8D	27	8D	35	8D	35
8D	33	8D	30	8D	2C	8D	2D	8D	2F	8D	30	8D	33	8D	38	8D	3B	8D	3E	8D	42	8D	43
8D	41	8D	37	8D	25	8D	08	8C	E3	8C	B7	8C	8D	8C	66	8C	44	8C	32	8C	2B	8C	28
8C	25	8C	20	8C	1F	8C	1B	8C	17	8C	19	8C	1A	8C	1D	8C	1F	8C	22	8C	23	8C	25

8C	2C	8C	38	8C	50	8C	75	8C	9F	8C	CB	8C	F5	8D	16	8D	2B	8D	30	8D	2C	8D	27
8D	26	8D	26	8D	26	8D	29	8D	2B	8D	2D	8D	31	8D	34	8D	39	8D	3A	8D	3B	8D	3C
8D	37	8D	2A	8D	11	8C	F2	8C	C7	8C	9A	8C	71	8C	4D	8C	36	8C	2D	8C	28	8C	26
8C	22	8C	20	8C	1C	8C	19	8C	19	8C	1C	8C	1D	8C	21	8C	23	8C	25	8C	27	8C	2E
8C	3B	8C	57	8C	7F	8C	AA	8C	D7	8C	FD	8D	1A	8D	28	8D	29	8D	24	8D	1F	8D	1E
8D	1E	8D	1D	8D	21	8D	25	8D	28	8D	2C	8D	31	8D	33	8D	36	8D	37	8D	36	8D	33
8D	2B	8D	17	8C	FA	8C	D0	8C	A4	8C	77	8C	53	8C	3E	8C	2E	8C	29	8C	25	8C	23
8C	1F	8C	1C	8C	19	8C	19	8C	1C	8C	20	8C	23	8C	23	8C	27	8C	29	8C	30	8C	40
8C	5E	8C	86	8C	B0	8C	DB	8D	00	8D	1B	8D	22	8D	20	8D	1A	8D	18	8D	17	8D	18
8D	18	8D	1D	8D	22	8D	25	8D	2A	8D	2D	8D	30	8D	32	8D	33	8D	31	8D	2F	8D	28
8D	17	8C	FB	8C	D6	8C	A9	8C	7F	8C	58	8C	3E	8C	30	8C	2A	8C	25	8C	23	8C	20
8C	1C	8C	1A	8C	1A	8C	1D	8C	20	8C	23	8C	25	8C	27	8C	2B	8C	32	8C	42	8C	61
8C	88	8C	B4	8C	DC	8C	FE	8D	16	8D	1C	8D	18	8D	14	8D	12	8D	12	8D	13	8D	14
8D	19	8D	1F	8D	23	8D	26	8D	2B	8D	2C	8D	2E	8D	2E	8D	2C	8D	2B	8D	23	8D	14
8C	FC	8C	D7	8C	AC	8C	81	8C	5A	8C	40	8C	30	8C	2B	8C	26	8C	24	8C	22	8C	1F
8C	1B	8C	1A	8C	1D	8C	21	8C	24	8C	26	8C	29	8C	2C	8C	35	8C	45	8C	61	8C	88
8C	B2	8C	D9	8C	FB	8D	10	8D	14	8D	13	8D	0F	8D	0D	8D	0D	8D	0F	8D	10	8D	16
8D	1A	8D	20	8D	24	8D	26	8D	2A	8D	2B	8D	2A	8D	28	8D	27	8D	1E	8D	0F	8C	F8
8C	D5	8C	AC	8C	82	8C	5A	8C	3E	8C	30	8C	2B	8C	26	8C	24	8C	21	8C	1D	8C	1E
8C	1C	8C	1F	8C	23	8C	26	8C	29	8C	29	8C	2D	8C	35	8C	45	8C	5F	8C	86	8C	AD
8C	D3	8C	F4	8D	0A	8D	0E	8D	0D	8D	09	8D	08	8D	08	8D	0A	8D	0E	8D	12	8D	18
8D	1C	8D	20	8D	23	8D	26	8D	27	8D	27	8D	23	8D	22	8D	19	8D	0A	8C	F3	8C	D0
8C	A7	8C	7F	8C	59	8C	3E	8C	31	8C	2B	8C	28	8C	24	8C	22	8C	1E	8C	1D	8C	1C
8C	20	8C	22	8C	26	8C	2A	8C	2B	8C	30	8C	37	8C	44	8C	5C	8C	80	8C	A6	8C	CB
8C	EB	8D	01	8D	09	8D	07	8D	04	8D	02	8D	04	8D	06	8D	09	8D	0E	8D	14	8D	19
8D	1C	8D	20	8D	22	8D	21	8D	21	8D	1F	8D	1B	8D	12	8D	02	8C	E9	8C	C7	8C	9F
8C	7B	8C	56	8C	3E	8C	31	8C	2C	8C	27	8C	25	8C	23	8C	1F	8C	1D	8C	1B	8C	1F
8C	24	8C	26	8C	2B	8C	2E	8C	32	8C	38	8C	43	8C	58	8C	7A	8C	9D	8C	C1	8C	DF
8C	F7	8D	01	8D	03	8D	02	8D	00	8D	02	8D	02	8D	06	8D	0A	8D	0D	8D	11	8D	17
8D	1A	8D	1B	8D	1D	8D	1C	8D	19	8D	13	8D	0B	8C	FA	8C	DE	8C	BB	8C	94	8C	70
8C	50	8C	3B	8C	31	8C	2C	8C	27	8C	25	8C	23	8C	1F	8C	1C	8C	1C	8C	1F	8C	24
8C	28	8C	2B	8C	30	8C	33	8C	37	8C	42	8C	53	8C	6F	8C	90	8C	B2	8C	D1	8C	EB
8C	FA	8C	FF	8C	FE	8C	FD	8C	FF	8D	00	8D	02	8D	06	8D	09	8D	0E	8D	10	8D	13
8D	14	8D	15	8D	14	8D	12	8D	0B	8D	00	8C	EC	8C	D1	8C	AF	8C	8C	8C	66	8C	4A
8C	38	8C	2E	8C	2C	8C	27	8C	26	8C	22	8C	1F	8C	1E	8C	1A	8C	1F	8C	24	8C	27
8C	2B	8C	2F	8C	34	8C	38	8C	40	8C	4F	8C	66	8C	84	8C	A4	8C	C2	8C	DC	8C	EF
8C	FA	8C	FD	8C	FD	8C	FE	8C	FD	8D	00	8D	04	8D	06	8D	08	8D	0A	8D	0D	8D	0F
8D	0E	8D	0E	8D	0B	8D	02	8C	F3	8C	DB	8C	C1	8C	9E	8C	7E	8C	5B	8C	43	8C	34
8C	2E	8C	2B	8C	28	8C	27	8C	22	8C	1F	8C	1C	8C	1A	8C	1E	8C	23	8C	29	8C	2C
8C	30	8C	34	8C	39	8C	3F	8C	4B	8C	5C	8C	75	8C	94	8C	B0	8C	CB	8C	E1	8C	F2
8C	F9	8C	FC	8C	FE	8C	FE	8D	01	8D	02	8D	03	8D	04	8D	05	8D	07	8D	09	8D	08
8D	04	8C	FE	8C	F3	8C	E1	8C	CA	8C	AC	8C	8B	8C	6C	8C	4F	8C	3C	8C	32	8C	2E
8C	2C	8C	27	8C	25	8C	22	8C	21	8C	1D	8C	1A	8C	1E	8C	22	8C	28	8C	2C	8C	31
8C	34	8C	36	8C	3C	8C	44	8C	54	8C	68	8C	83	8C	9C	8C	B8	8C	D0	8C	E3	8C	F1
8C	FA	8D	00	8D	01	8D	03	8D	04	8D	03	8D	02	8D	03	8D	02	8D	00	8C	FE	8C	F9
8C	EF	8C	DF	8C	CC	8C	B1	8C	96	8C	7A	8C	5D	8C	45	8C	36	8C	2F	8C	2D	8C	2D
8C	28	8C	27	8C	23	8C	21	8C	1C	8C	19	8C	1D	8C	22	8C	25	8C	2B	8C	2F	8C	33
8C	37	8C	3C	8C	43	8C	4C	8C	5D	8C	72	8C	8A	8C	A2	8C	BC	8C	CF	8C	E4	8C	F3
8C	FE	8D	02	8D	04	8D	04	8D	02	8D	01	8C	FF	8C	FC	8C	F8	8C	F2	8C	E8	8C	DA
8C	C8	8C	B4	8C	99	8C	80	8C	65	8C	4E	8C	3D	8C	33	8C	2E	8C	2B	8C	29	8C	28
8C	25	8C	22	8C	1F	8C	1C	8C	17	8C	1C	8C	20	8C	25	8C	28	8C	2E	8C	32	8C	35
8C	3A	8C	3F	8C	46	8C	51	8C	61	8C	75	8C	8C	8C	A3	8C	BA	8C	CE	8C	DF	8C	EE
8C	F8	8C	FC	8D	01	8C	FE	8C	FB	8C	F7	8C	F1	8C	E8	8C	DC	8C	D2	8C	C3	8C	B1
8C	9A	8C	83	8C	6A	8C	54	8C	42	8C	36	8C	31	8C	2C	8C	2C	8C	29	8C	27	8C	23
8C	22	8C	1C	8C	1B	8C	18	8C	19	8C	20	8C	23	8C	27	8C	2C	8C	30	8C	32	8C	38
8C	3B	8C	41	8C	48	8C	54	8C	64	8C	78	8C	8C	8C	A1	8C	B5	8C	C7	8C	D6	8C	DF
8C	E9	8C	EE	8C	EC	8C	EA	8C	E3	8C	DA	8C	D0	8C	C5	8C	B7	8C	A6	8C	95	8C	80
8C	6C	8C	56	8C	45	8C	3A	8C	32	8C	31	8C	2D	8C	2C	8C	28	8C	25	8C	23	8C	1F
8C	1C	8C	19	8C	16	8C	1A	8C	1D	8C	22	8C	27	8C	2A	8C	2E	8C	33	8C	35	8C	3A
8C	3C	8C	42	8C	49	8C	55	8C	65	8C	77	8C	88	8C	9A	8C	AB	8C	BB	8C	C5	8C	CE
8C	D1	8C	D3	8C	CE	8C	C7	8C	C0	8C	B5	8C	A7	8C	9A	8C	8C	8C	7A	8C	67	8C	56
8C	46	8C	3B	8C	35	8C	2F	8C	2E	8C	2D	8C	2A	8C	26	8C	26	8C	22	8C	1F	8C	1A
8C	17	8C	15	8C	18	8C	1D	8C	21	8C	25	8C	29	8C	2D	8C	31	8C	34	8C	38	8C	3A
8C	3E	8C	43	8C	49	8C	54	8C	62	8C	72	8C	81	8C	8F	8C	9A	8C	A7	8C	AE	8C	B3
8C	B2	8C	AF	8C	AA	8C	A1	8C	96	8C	8B	8C	80	8C	70	8C	61	8C	53	8C	46	8C	3C
8C	36	8C	32	8C	2F	8C	2D	8C	2A	8C	27	8C	24	8C	24	8C	20	8C	1C	8C	1A	8C	14
8C	13	8C	18	8C	1A	8C	1F	8C	23	8C	27	8C	2A	8C	2E	8C	31	8C	34	8C	37	8C	3B
8C	3D	8C	41	8C	48	8C	53	8C	5B	8C	67	8C	74	8C	7F	8C	86	8C	8F	8C	92	8C	93
8C	92	8C	8A	8C	84	8C	7B	8C	71	8C	66	8C	59	8C	4F	8C	45	8C	3C	8C	36	8C	32
8C	32	8C	2E	8C	2B	8C	28	8C	26	8C	24	8C	21	8C	20	8C	1B	8C	17	8C	14	8C	13
8C	15	8C	19	8C	1C	8C	22	8C	24	8C	29	8C	2B	8C	2F	8C	33	8C	35	8C	39	8C	3A
8C	3C	8C	41	8C	46	8C	4B	8C	53	8C	5B	8C	64	8C	6C	8C	70	8C	76	8C	75	8C	73
8C	6B	8C	68	8C	61	8C	58	8C	50	8C	48	8C	42	8C	3A	8C	38	8C	33	8C	31	8C	2E
8C	2D	8C	29	8C	27	8C	25	8C	23	8C	21	8C	1C	8C	1B	8C	17	8C	14	8C	10	8C	13
8C	17	8C	1A	8C	20	8C	23	8C	26	8C	2A	8C	2E	8C	30	8C	33	8C	37	8C	39	8C	39
8C	3D	8C	3E	8C	43	8C	46	8C	49	8C	4F	8C	54	8C	57	8C	59	8C	5A	8C	58	8C	57
8C	51	8C	4E	8C	48	8C	44	8C	40	8C	3B	8C	38	8C	36	8C	33	8C	30	8C	2E	8C	2D
8C	2A	8C	25	8C	23	8C	20	8C	1D	8C	1C	8C	18	8C	14	8C	0F	8C	0E	8C	11	8C	13
8C	1A	8C	1D	8C	21	8C	24	8C	29	8C	2B	8C	2D	8C	30	8C	33	8C	36	8C	38	8C	39
8C	39	8C	3D	8C	40	8C	41	8C	44	8C	46	8C	46	8C	48	8C	49	8C	49	8C	49	8C	45
8C	43	8C	40	8C	3D	8C	39	8C	38	8C	35	8C	34	8C	31	8C	31	8C	2D	8C	2A	8C	27
8C	26	8C	22	8C	20	8C	1C	8C	1A	8C	17	8C	12	8C	0E	8C	0D	8C	0F	8C	13	8C	19

8C	1D	8C	1F	8C	24	8C	26	8C	29	8C	2B	8C	2C	8C	2E	8C	31	8C	33	8C	35	8C	36
8C	38	8C	3B	8C	3A	8C	3C	8C	3E	8C	3E	8C	3F	8C	40	8C	40	8C	3F	8C	3E	8C	3B
8C	3B	8C	3A	8C	38	8C	34	8C	32	8C	31	8C	2F	8C	2C	8C	2A	8C	2A	8C	24	8C	23
8C	22	8C	1F	8C	1C	8C	18	8C	15	8C	14	8C	0C	8C	0A	8C	0C	8C	11	8C	15	8C	1A
8C	1D	8C	22	8C	24	8C	26	8C	29	8C	2C	8C	2C	8C	2F	8C	32	8C	31	8C	34	8C	35
8C	35	8C	36	8C	39	8C	39	8C	39	8C	38	8C	3A	8C	3B	8C	39	8C	3A	8C	39	8C	38
8C	35	8C	35	8C	34	8C	30	8C	2F	8C	2C	8C	2A	8C	27	8C	26	8C	22	8C	22	8C	1F
8C	1D	8C	18	8C	18	8C	15	8C	0F	8C	0C	8C	06	8C	0C	8C	0F	8C	14	8C	18	8C	1B
8C	1E	8C	21	8C	25	8C	26	8C	29	8C	2B	8C	2C	8C	2D	8C	2F	8C	30	8C	30	8C	32
8C	33	8C	33	8C	35	8C	35	8C	33	8C	35	8C	34	8C	33	8C	35	8C	34	8C	33	8C	32
8C	30	8C	31	8C	2D	8C	2C	8C	2A	8C	28	8C	26	8C	23	8C	21	8C	1F	8C	1E	8C	1A
8C	18	8C	14	8C	12	8C	0D	8C	0B	8C	05	8C	08	8C	0D	8C	11	8C	14	8C	19	8C	1C
8C	1D	8C	21	8C	23	8C	24	8C	27	8C	28	8C	2A	8C	2B	8C	2C	8C	2C	8C	2E	8C	2D
8C	2F	8C	31	8C	30	8C	2F	8C	30	8C	30	8C	31	8C	2E	8C	2E	8C	2F	8C	2D	8C	2D
8C	2B	8C	2B	8C	26	8C	26	8C	26	8C	22	8C	21	8C	1E	8C	1D	8C	1B	8C	19	8C	16
8C	11	8C	0F	8C	0A	8C	07	8C	00	8C	03	8C	0B	8C	0E	8C	13	8C	15	8C	18	8C	1C
8C	20	8C	21	8C	23	8C	25	8C	26	8C	27	8C	2A	8C	29	8C	2A	8C	2A	8C	2A	8C	2D
8C	2D	8C	2D	8C	2D	8C	2C	8C	2D	8C	2C	8C	2C	8C	2A	8C	2B	8C	2A	8C	2A	8C	28
8C	26	8C	26	8C	23	8C	22	8C	1F	8C	1E	8C	1D	8C	1B	8C	19	8C	16	8C	14	8C	11
8C	0E	8C	0A	8C	03	8B	F9	8C	01	8C	07	8C	0E	8C	10	8C	14	8C	17	8C	19	8C	1D
8C	1E	8C	20	8C	23	8C	25	8C	26	8C	27	8C	28	8C	28	8C	28	8C	27	8C	27	8C	28
8C	29	8C	2A	8C	29	8C	2B	8C	28	8C	28	8C	27	8C	29	8C	26	8C	26	8C	26	8C	25
8C	21	8C	23	8C	1F	8C	1E	8C	1C	8C	1C	8C	1A	8C	18	8C	16	8C	15	8C	0F	8C	0B
8C	03	8C	03	**45**	**4E**																		

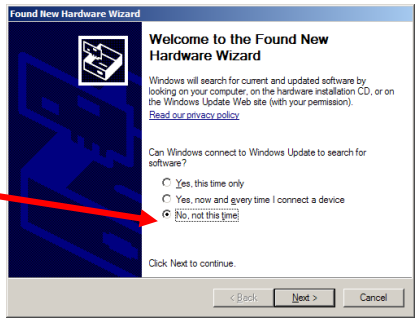
Appendix 2 - Hex to ASCII Conversion table.

DEC	HEX	Char		DEC	HEX	Char	DEC	HEX	Char	DEC	HEX	Char
0	00	NUL	null	32	20	Space	64	40	@	96	60	`
1	01	SOH	start of heading	33	21	!	65	41	A	97	61	a
2	02	STX	start of text	34	22	"	66	42	B	98	62	b
3	03	ETX	end of text	35	23	#	67	43	C	99	63	c
4	04	EOT	end of transmission	36	24	$	68	44	D	100	64	d
5	05	ENQ	enquiry	37	25	%	69	45	E	101	65	e
6	06	ACK	acknowledge	38	26	&	70	46	F	102	66	f
7	07	BEL	bell	39	27	'	71	47	G	103	67	g
8	08	BS	backspace	40	28	(	72	48	H	104	68	h
9	09	TAB	horizontal tab	41	29	)	73	49	I	105	69	i
10	0A	LF	NL line feed	42	2A	*	74	4A	J	106	6A	j
11	0B	VT	vertical tab	43	2B	+	75	4B	K	107	6B	k
12	0C	FF	NP form feed	44	2C	,	76	4C	L	108	6C	l
13	0D	CR	carriage return	45	2D	-	77	4D	M	109	6D	m
14	0E	SO	shift out	46	2E	.	78	4E	N	110	6E	n
15	0F	SI	shift in	47	2F	/	79	4F	O	111	6F	o
16	10	DLE	data link escape	48	30	0	80	50	P	112	70	p
17	11	DC1	device control 1	49	31	1	81	51	Q	113	71	q
18	12	DC2	device control 2	50	32	2	82	52	R	114	72	r
19	13	DC3	device control 3	51	33	3	83	53	S	115	73	s
20	14	DC4	device control 4	52	34	4	84	54	T	116	74	t
21	15	NAK	negative acknowledge	53	35	5	85	55	U	117	75	u
22	16	SYN	synchronous idle	54	36	6	86	56	V	118	76	v
23	17	ETB	end of trans. Block	55	37	7	87	57	W	119	77	w
24	18	CAN	cancel	56	38	8	88	58	X	120	78	x
25	19	EM	end of medium	57	39	9	89	59	Y	121	79	y
26	1A	SUB	substitute	58	3A	:	90	5A	Z	122	7A	z
27	1B	ESC	escape	59	3B	;	91	5B	[	123	7B	{
28	1C	FS	file separator	60	3C	<	92	5C	\	124	7C	|
29	1D	GS	group separator	61	3D	=	93	5D	]	125	7D	}
30	1E	RS	record separator	62	3E	>	94	5E	^	126	7E	~
31	1F	US	unit separator	63	3F	?	95	5F	_	127	7F	DEL

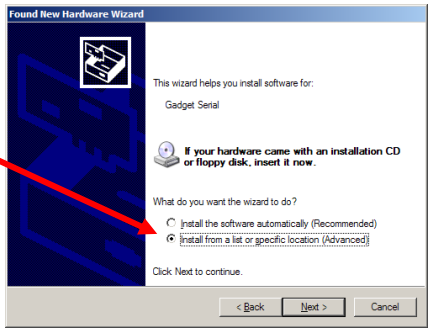
Appendix 3 - Installing the Driver

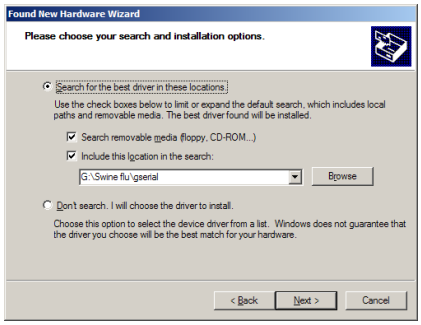
Windows XP

Chose the "No, not this time option" and click "next".

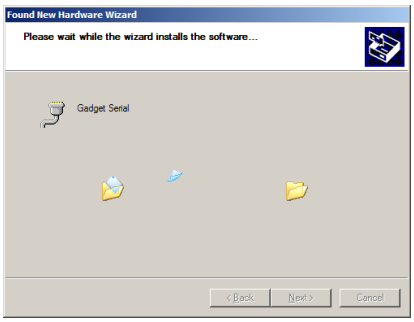


1. Ensure the CD is inserted and
2. select the "install from a list or specific location"
3. Click on "next".

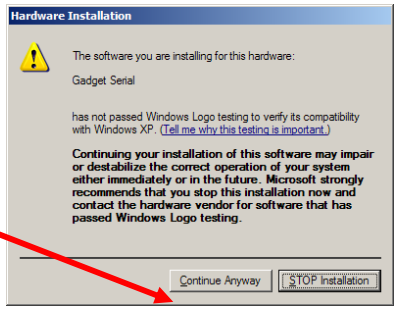


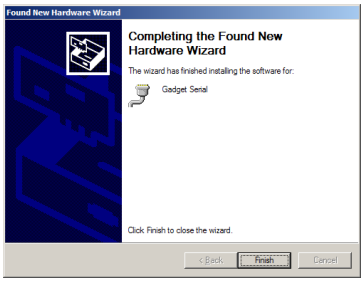


Installing the Driver.



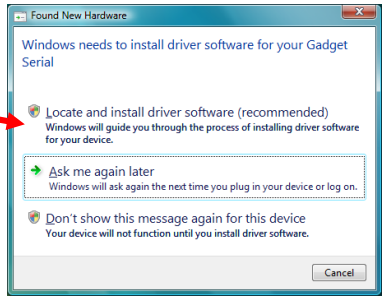
Select and click on the "continue anyway"



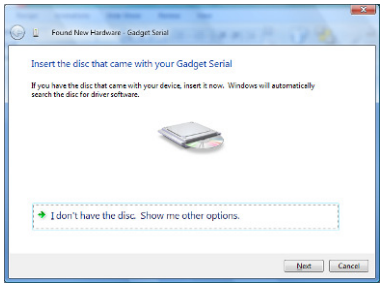


WINDOWS VISTA
(Note: does not work with 64 bit VISTA)

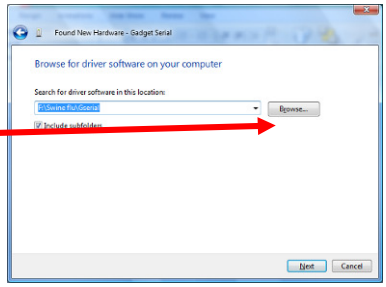
First screen shot when connecting to a VISTA PC.
Select Locate and Install driver software option.



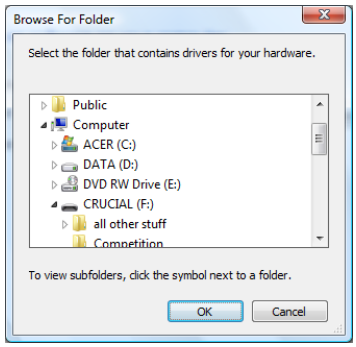
If the software is not on the CD select "I don't have the disc" option. The two screen shots below only apply if this option is selected.



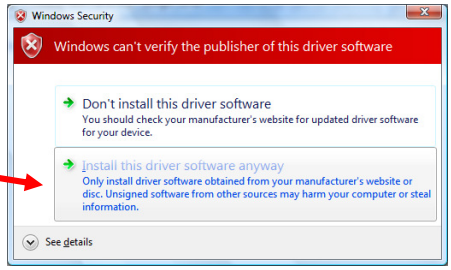
If the "I don't have the Disc" option was selected, click on browse.



Browse through the folders to locate the location with the software.



Select "Install this driver software anyway"



Software loaded.