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HHT User Manual

Document # 200422

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Approvals

Revision	Name	Title	Signature
04	Edward Li	General Manager	

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DEFINITIONS AND ABBREVIATIONS

The following terms and/or abbreviations are used in this manual:

Term	Definition
IR	Infrared – the type of communications interface which the HHT uses to transmit data.
SAE J2799	The SAE standard that defines the serial packets that are sent via infrared, from a fuel cell vehicle to a hydrogen station.
HHT	Hand-held transmitter – the product discussed in this manual, which is used to test infrared data communications.

APPLICABLE DOCUMENTS

The following documents are recommended as reference material.

Document Reference	Document Title	Document Number
[1]	SAE J2799 technical information report	J2799

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1 SCOPE

This user manual provides an overview description of the **hand-held transmitter (HHT)**, a hand-held device used to test the IR communication at a hydrogen fueling station.

2 INTRODUCTION

The **SAE J2799 standard** is a method of communicating information such as tank pressure and tank temperature from a hydrogen-powered vehicle to a hydrogen fueling station, during a fueling operation, using infrared. This communication is used to ensure that the hydrogen fueling is conducted in a controlled and safe manner.

The **HHT** is a hand-held device that can be used to test the infrared data communication at a hydrogen dispenser. The HHT is preprogrammed with a set of four test patterns that can be transmitted to the hydrogen station. The HHT can also be programmed by the user with a custom set of test patterns.



FIGURE 2-1 HHT (HAND-HELD TRANSMITTER) FRONT VIEW

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This manual includes the following:

- An overview of the HHT, including:
 - HHT interface details;
 - Pre-programmed test pattern information; and,
 - A quick-start guide.
- A guide to programming the HHT with user-defined test patterns, including:
 - An overview of SAE J2799 infrared data packets; and,
 - A guide to using the HHT test pattern software to program the HHT.
- A troubleshooting section;
- A guide to installing the HHT test pattern software; and,
- A guide to updating the HHT firmware if/when new firmware upgrades are released.

3 REQUIREMENTS

The HHT requires the following equipment:

TABLE 3-1: REQUIRED EQUIPMENT

Qty	Part #	Description
1	200428	HHT (hand-held transmitter)
1		Desktop or laptop computer, Windows 2000 or higher
1	200421	HHT test pattern software
1		USB cable (supplied by user) – USB A-Type to USB Mini-b (5-pin)

The batteries used in the HHT **must be purchased** on the one of the two following web sites:

Eve Batteries ER1405 at <http://www.evebattery.com/en2/join.html>

SAFT battery LS14500 at Amazon.com

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4 GETTING STARTED

The HHT is a simple hand-held device that allows the user to select one of **four pre-programmed IRDI test patterns** to transmit to a hydrogen nozzle.

4.1 HHT USER INTERFACE

The HHT has the following features:

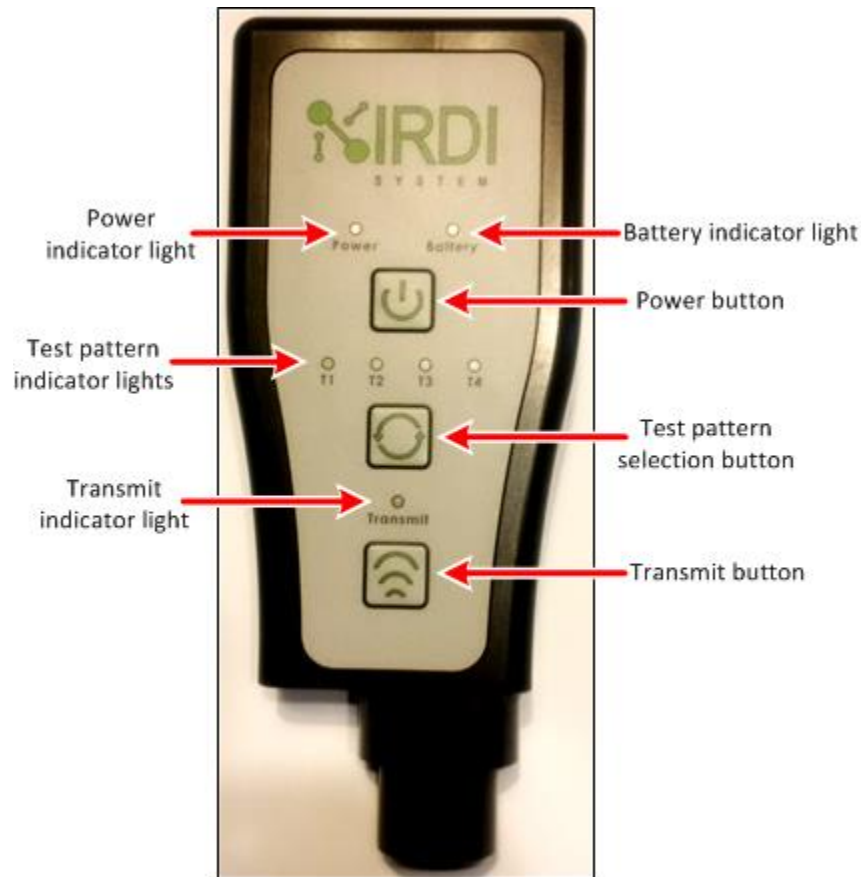


FIGURE 4-1 HHT FEATURES – BUTTONS AND LIGHTS

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Button/LED	Action
Power button	<p>a. When the HHT is turned off, hold the power button down for approximately 2 seconds to turn on the HHT.</p> <p>b. When the HHT is turned on, hold the power button down for approximately 2 seconds to turn off the HHT.</p> <p>NOTE: If the HHT is idle for 5 minutes or more, it will turn off automatically.</p>
Power indicator light	The light is on when the HHT is powered up.
Battery indicator light	The light is on when the batteries need to be changed.
Test pattern selection button	When the HHT is turned on, press the test button to change the test pattern to one of the 4 selections – T1, T2, T3 or T4. Each time the test button is pressed, the selection moves to the next test pattern (e.g. from T2 to T3).
Test pattern indicator lights	<p>The light is on when the corresponding test pattern is selected (e.g. T1 light is on when test pattern T1 is selected).</p> <p>NOTE: Only one test pattern can be selected at any given time.</p>
Transmit button	<p>1. When the HHT is turned on, press & release the transmit button to send the selected test pattern – all test packets in the test pattern will be transmitted through once, at 100 ms intervals.</p> <p>2. When the HHT is turned on, press-&hold (<i>for 4 seconds, minimum</i>) & release the transmit button to send the selected test pattern continuously – all test packets in the test pattern will be transmitted through, at 100 ms intervals, and repeated.</p> <p>Press-&hold (<i>for 4 seconds, minimum</i>) & release the transmit button to finish the selected test pattern and stop</p> <p>NOTE: While a test pattern is being transmitted, all other button presses will be ignored [except press-&hold (<i>for 4 seconds, minimum</i>) & release the transmit button]</p>
Transmit indicator light	The light is on while the HHT is transmitting a test pattern. The light goes off when the test pattern is finished transmitting.

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The HHT's infrared transmitter is located as follows:



FIGURE 4-2 HHT INFRARED TRANSMITTER LOCATION

4.2 CHANGING THE BATTERIES

The HHT uses two **special 3.5 V AA batteries**. Please purchase these batteries from the one of the following two suppliers **only**:

Eve Batteries ER1405 at <http://www.evebattery.com/en2/join.html>

SAFT battery LS14500 at Amazon.com

To change the batteries in the HHT, do the following:

Action	
STEP 1	Using a 2.5 mm HEX driver, open the back cover of the HHT.
STEP 2	Remove the old batteries – see Figure 4-3.

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Action	
STEP 3	Install two new batteries. Make sure to place the batteries in the right orientation – see the polarity markings on the circuit board under the battery holders.
STEP 4	Using a 2.5 mm HEX driver, reattach the back cover of the HHT.
STEP 5	Test the new batteries - press and hold the power button on the HHT for about 2 seconds, until the “power” light comes on.

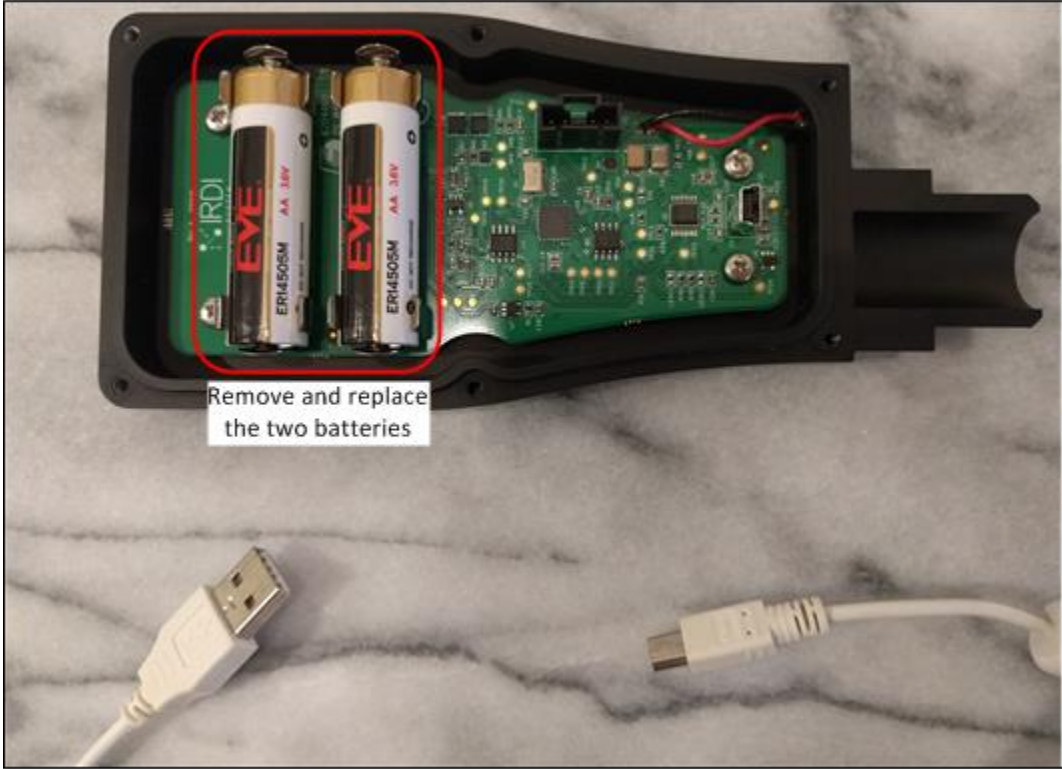


FIGURE 4-3 HHT BATTERIES – LOCATION IN HHT

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4.3 HHT QUICK-START GUIDE

To use the HHT, do the following:

Action	
STEP 1	Prepare the hydrogen dispenser to display and record IR data.
STEP 2	Press and hold the power button on the HHT for about 2 seconds, until the “power” light comes on.
STEP 3	Press the “test pattern selection” button on the HHT, to select the test pattern (T1, T2, T3 or T4) - the associated LED for the selection will light up.
STEP 4	Holding the nozzle in one hand, insert the HHT into the end of the hydrogen nozzle, as shown in Figure 4-4 below.
STEP 5	Press the “transmit” button on the HHT, to transmit the selected test pattern. Verify that the station received the IRDI test pattern correctly.
STEP 6	Repeat steps 3 and 5 above, to transmit additional test patterns.
NOTE	To turn off the HHT, press and hold the power button for about 2 seconds.



FIGURE 4-4 HHT ATTACHED TO HYDROGEN NOZZLE

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NOTES

Action	
NOTE 1	The HHT will turn off automatically after 5 minutes.
NOTE 2	If the battery is too low to operate, pressing the power button will cause the battery light to come on for 3 seconds, after which the HHT will power down.
NOTE 3	If the HHT is on and the battery voltage falls below the operating threshold, the battery light will turn on, and the HHT will continue to function.
NOTE 4	If the battery light is on, and the HHT is turned off, the user will no longer be able to turn on the HHT – if the power button is pressed, the battery light will come on for 3 seconds, then the HHT will turn off.

4.4 PRE-PROGRAMMED (DEFAULT) TEST PATTERNS

The HHT is delivered with **four pre-programmed (default)** infrared data message test patterns - T1, T2, T3 and T4.

These four pre-programmed test patterns are as follows:

4.4.1 Test Pattern 1 (T1)

NOTE: The BOF, CRC and EOF fields are included but not shown.

Number of transmitted IRDI packets: 5 identical test patterns, as follows:

Line #	Test Pattern	OD Field
1	ID=SAE J2799 VN=1.10 TV=0180.0 RT=H70 FC=Dyna MP=010.0 MT=116.0	None

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4.4.2 Test Pattern 2 (T2)

NOTE: The BOF, CRC and EOF fields are included but not shown.

Number of transmitted IRDI packets: 10 test patterns with changing MP and MT data, as follows:

Line #	Test Pattern	OD Field
1, 3, 5, 7, 9	ID=SAE J2799 VN=1.10 TV=0180.0 RT=H70 FC=Dyna MP=010.0 MT=116.0	None
2, 4, 6, 8, 10	ID=SAE J2799 VN=1.10 TV=0180.0 RT=H70 FC=Dyna MP=030.0 MT=350.0	None

4.4.3 Test Pattern 3 (T3)

NOTE: The BOF, CRC and EOF fields are included but not shown.

Number of transmitted IRDI packets: 50 test patterns with increasing MP and MT data, as follows:

Line #	Test Pattern	OD Field
1 to 25	ID=SAE J2799 VN=1.10 TV=0180.0 RT=H70 FC=Halt MP=X MT=Y NOTE: see table # below for the MP and MT values	None
26 to 50	ID=SAE J2799 VN=1.10 TV=0180.0 RT=H70 FC=Abort MP=X MT=Y NOTE: see Table 4-1 below for the MP and MT values	None

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TABLE 4-1 TEST PATTERN 3 – MT AND MP VALUES

Line #	MP, X Value	MT, Y Value	Line #	MP, X Value	MT, Y Value
1	0	20	26	25	170
2	1	26	27	26	176
3	2	32	28	27	182
4	3	38	29	28	188
5	4	44	30	29	194
6	5	50	31	30	200
7	6	56	32	31	206
8	7	62	33	32	212
9	8	68	34	33	218
10	9	74	35	34	224
11	10	80	36	35	230
12	11	86	37	36	236
13	12	92	38	37	242
14	13	98	39	38	248
15	14	104	40	39	254
16	15	110	41	40	260
17	16	116	42	41	266
18	17	122	43	42	272
19	18	128	44	43	278
20	19	134	45	44	284
21	20	140	46	45	290
22	21	146	47	46	296
23	22	152	48	47	302
24	23	158	49	48	308
25	24	164	50	49	314

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4.4.4 Test Pattern 4 (T4)

NOTE: The BOF, CRC and EOF fields are included but not shown.

Number of transmitted IRDI packets: 100 test patterns with increasing MP and MT data, as follows:

Line #	Test Pattern	OD Field
1 to 100	ID=SAE J2799 VN=1.10 TV=0180.0 RT=H70 FC=Halt MP=X MT=Y NOTE: see Table 4-2 below for the MP and MT values	None

TABLE 4-2 TEST PATTERN 4 – MT AND MP VALUES

Line #	MP, X Value	MT, Y Value	Line #	MP, X Value	MT, Y Value
1	0	20	51	25	268
2	0.5	25	52	26	271
3	1	30	53	26	274
4	2	35	54	27	277
5	2	40	55	27	280
6	3	45	56	28	283
7	3	50	57	28	286
8	4	55	58	29	289
9	4	60	59	29	292
10	5	65	60	30	295
11	5	70	61	30	298
12	6	75	62	31	301
13	6	80	63	31	304
14	7	85	64	32	307
15	7	90	65	32	310
16	8	95	66	33	313
17	8	100	67	33	316
18	9	105	68	34	319
19	9	110	69	34	322



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Line #	MP, X Value	MT, Y Value	Line #	MP, X Value	MT, Y Value
20	10	115	70	35	325
21	10	120	71	35	328
22	11	125	72	36	331
23	11	130	73	36	334
24	12	135	74	37	337
25	12	140	75	37	340
26	13	145	76	38	343
27	13	150	77	38	346
28	14	155	78	39	349
29	14	160	79	39	352
30	15	165	80	40	355
31	15	170	81	40	358
32	16	175	82	41	361
33	16	180	83	41	364
34	17	185	84	42	367
35	17	190	85	42	370
36	18	195	86	43	373
37	18	200	87	43	376
38	19	205	88	44	379
39	19	210	89	44	382
40	20	215	90	45	385
41	20	220	91	45	388
42	21	225	92	46	391
43	21	230	93	46	394
44	22	235	94	47	397
45	22	240	95	47	400
46	23	245	96	48	403
47	23	250	97	48	406
48	24	255	98	49	409
49	24	260	99	49	412
50	25	265	100	50	415

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5 USING THE HHT TEST PATTERN SOFTWARE

The HHT is delivered with four pre-programmed (default) test patterns (see Section 4.4 for details). To **change these test patterns**, use the supplied **HHT test pattern software**. This section describes how to use the HHT test pattern software.

5.1 INTRODUCTION TO INFRARED DATA MESSAGES

The HHT transmits infrared data messages through an infrared data transmitter. The user can receive these messages via a user-supplied infrared data receiver, and can view these messages using any terminal program, such as HyperTerminal.

Each infrared data message is a text string of fixed length, with a fixed set of fields, as per the following example:

```
ÿÿÿÿÿÀ|ID=SAEJ2799|VN=00.91|RT=H25|TV=0180.0|FC=STAT|MP=000.0|MT=016.0|MéÁ
```

The vertical lines (“|”) in the above string separate the individual fields that make up the infrared data message. Each field begins with the field identifier (e.g. “TV”), followed by the “=” symbol and the numeric value assigned to that field (e.g. “0180.0”). For example, in the above message, TV (tank volume) has the value 0180.0, which means that the tank volume is 180 l (litres).

The meaning of each field in the infrared data message is as follows:

TABLE 5-1: INFRARED DATA MESSAGE FIELDS

Field Identifier	Definition	Range of Values
ÿÿÿÿÿÀ	Delimiting characters that define start of infrared data message	n/a
ID	Name of the communication protocol – in this case, SAE J2799	SAEJ2799
VN	Version number of the communications protocol	00.00 – 99.99
RT	Receptacle type – style of hydrogen receptacle used on the vehicle	H25, H35, H50 and H70
TV	Tank volume – the volume of the hydrogen tank in the vehicle	0000.0 – 5000.0 litres
FC	Fill command – indicates the type of hydrogen fill in progress, or the reason for the fill's termination	DYNA, STAT, HALT and ABORT

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Field Identifier	Definition	Range of Values
MP	Measured pressure – the pressure reading of the hydrogen tank in the vehicle	000.0 – 100.0 MPa
MT	Measured temperature – the temperature reading of the hydrogen tank in the vehicle	16.0 – 425.0 K
OD	Optional data – any characters, up to a total of 16, as defined by the customer; used to transmit customer-specific information	Any characters, NOT INCLUDING the “ ” ASCII character or the “\$7C” hexadecimal character
MéÁ	Delimiting characters that define end of infrared data message, plus checksum	Varies depending on the checksum

5.2 GETTING STARTED WITH THE HHT TEST PATTERN SOFTWARE

The HHT can be programmed with new user-defined test patterns, using the HHT test pattern software.

The following figure shows the HHT with its back cover removed:

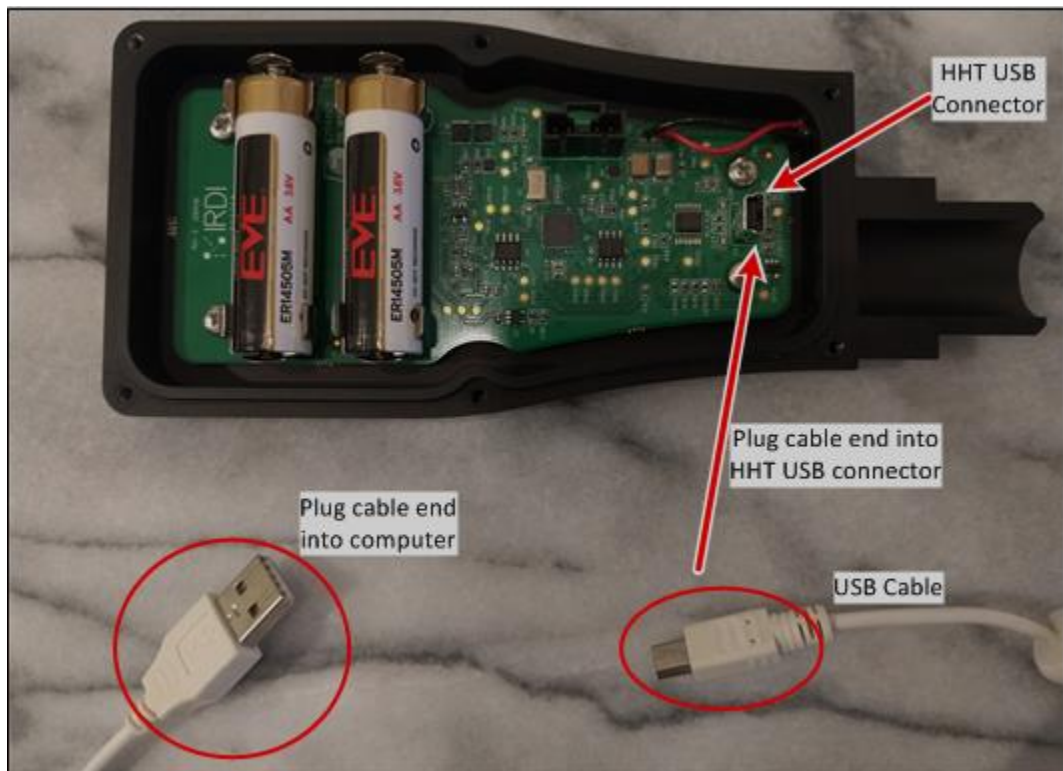


FIGURE 5-1 HHT PROGRAMMING SETUP

To set up the HHT for reprogramming, do the following:

Action	
STEP 1	Install the HHT test pattern software on a computer, as per Appendix A.
STEP 2	Using a 2.5 mm HEX driver, open the back cover of the HHT.
STEP 3	Attach the USB cable (5-pin Mini-b connector) to the USB connector on the HHT's circuit board – see Figure 5-1 above.
STEP 4	Attach the other end of the USB cable (A-type connector) to a USB port on your computer.

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Action	
STEP 5	Start the HHT test pattern software, by double-clicking on the “200421_R01 - IRDI HHT” application.
STEP 6	The HHT will turn on automatically – make sure that the power light is on. If the power light does not go on, press and hold the power button for approximately 3 seconds.
NOTE 1	The baud rate for communication between the HHT and the computer is 115,200 baud – this rate should be set automatically when you connect the HHT and the computer via the USB cable.
NOTE 2	While the HHT is connected and the test pattern software is running, the HHT will not go to sleep (will not turn off automatically).

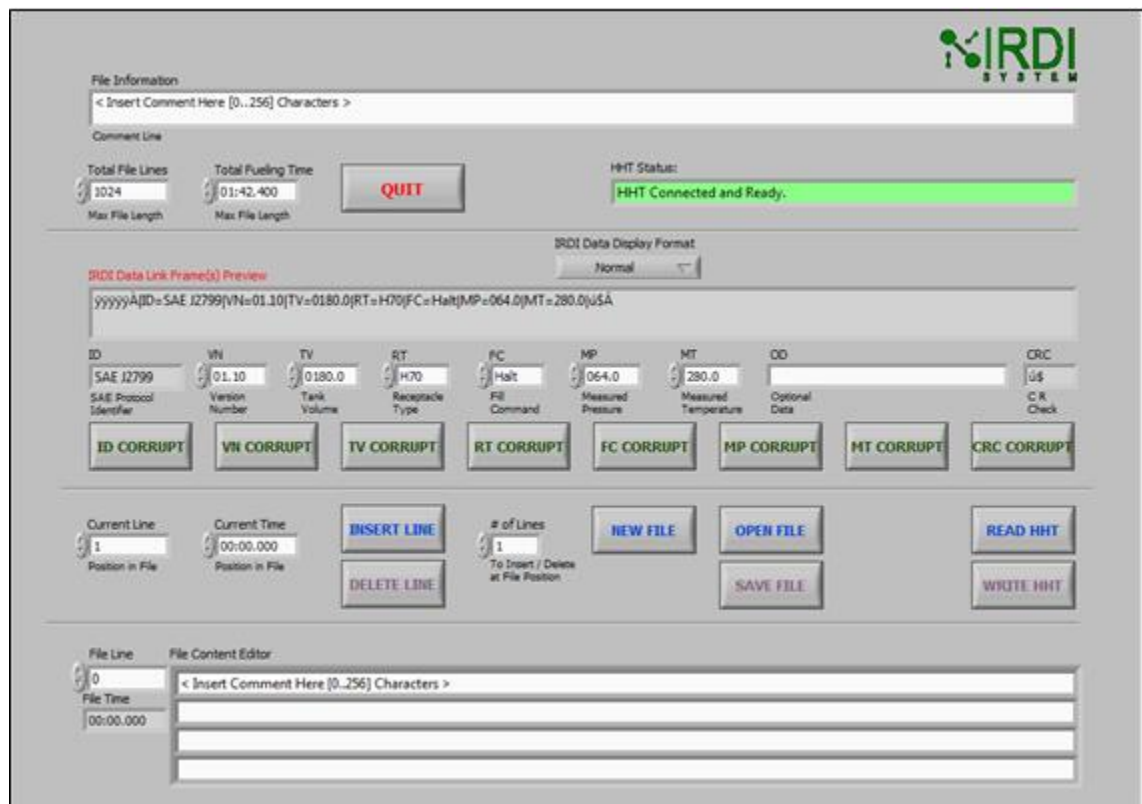


FIGURE 5-2 HHT TEST PATTERN SOFTWARE

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The HHT test pattern software screen is comprised of several areas, as follows:

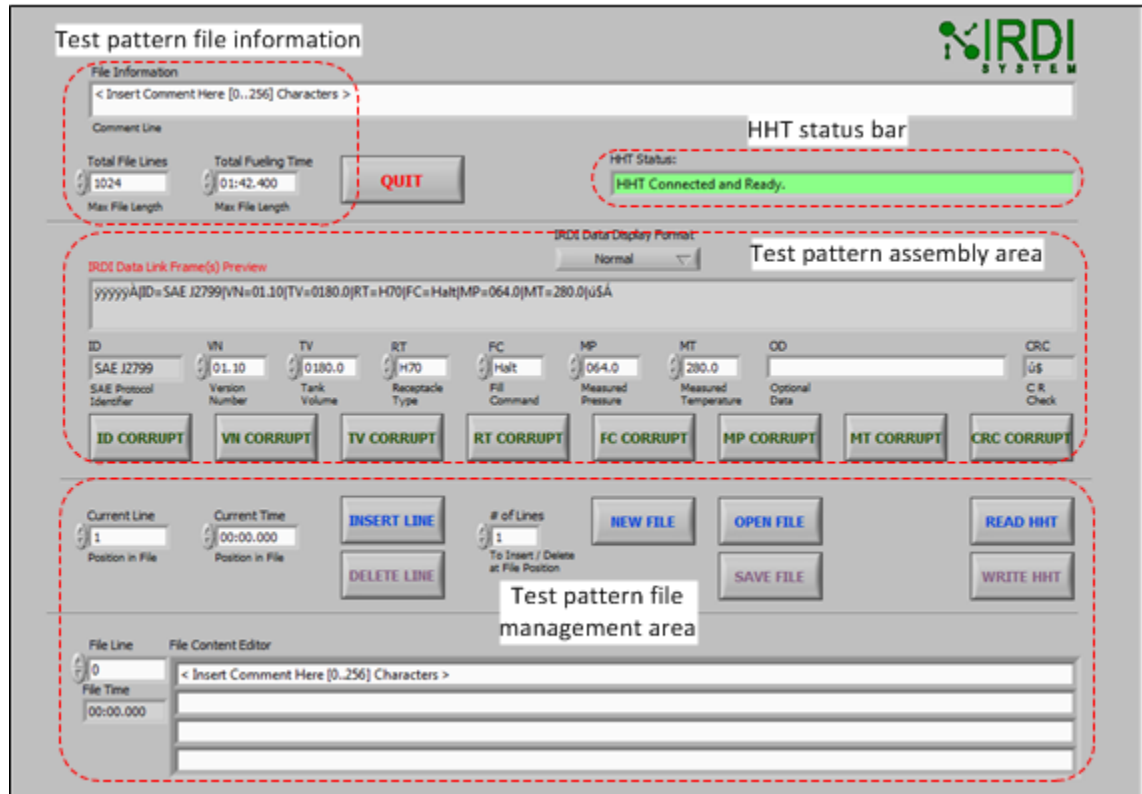


FIGURE 5-3 HHT TEST PATTERN SOFTWARE – SCREEN AREAS

The main screen areas include the following (refer to Figure 5-3 above):

- **Test pattern file information:**
 - Shows the file name or descriptor, the number of lines in the file, and the amount of time (total fueling time) it takes to transmit the file using the HHT.
- **HHT status bar:**
 - Shows the state of the HHT – either “Not Connected”, “HHT in Sleep Mode”, or “HHT Connected and Ready”.
- **Test pattern assembly area:**
 - Used to create a user-defined test pattern line, consisting of user-defined values for each IR data field.
 - NOTE: The CRC is generated automatically, based on the pattern values.

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- **Test pattern file management area:**
 - Used to create and save a new test pattern file, copy user-defined test patterns to a new file, open an existing test pattern file, and read and write test pattern files to and from the HHT.

5.3 OPENING A TEST PATTERN FILE

To open an existing test pattern file, do the following:

Action	
STEP 1	Click on the “OPEN FILE” button.
STEP 2	A browser window will appear - – see the following figure. Browse to the directory containing the file, and click on the file to select it.
STEP 3	Click on the “OK” button to open the file.
NOTE	A test pattern file can contain a maximum of 200,000 characters.

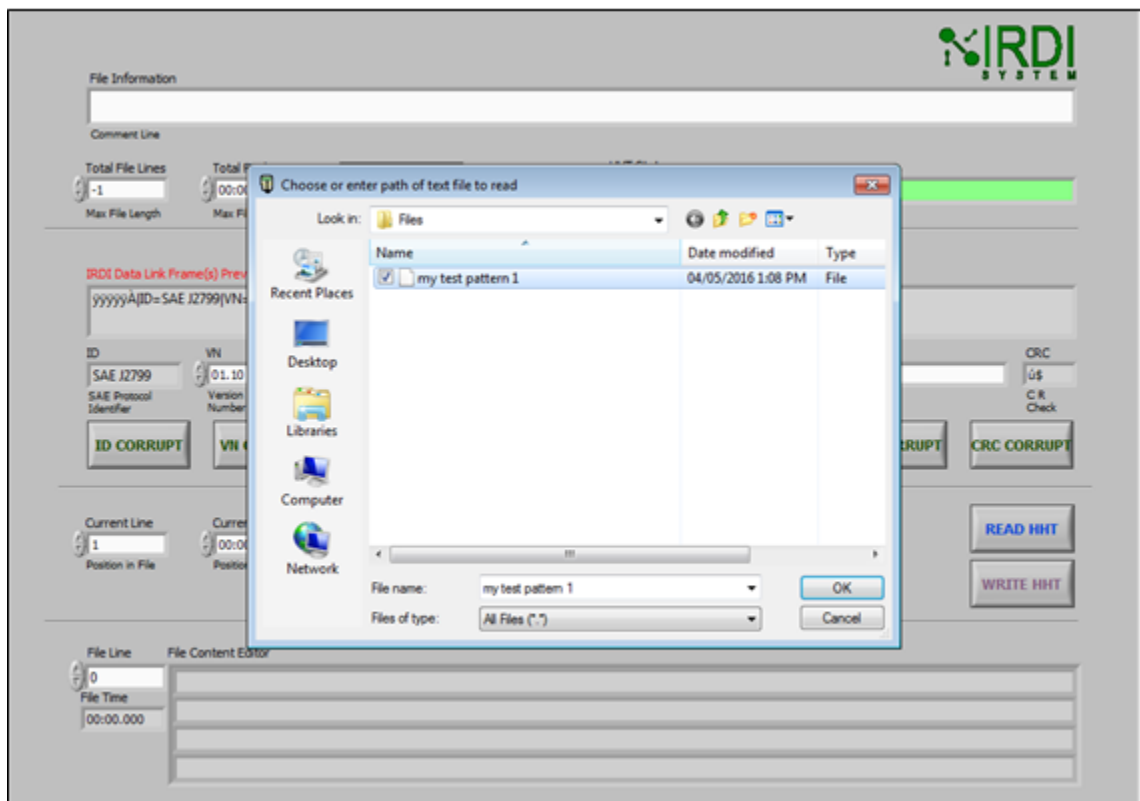


FIGURE 5-4 HHT TEST PATTERN SOFTWARE – SELECT A FILE TO OPEN

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The following figure shows the HHT test pattern screen, when a file is opened:

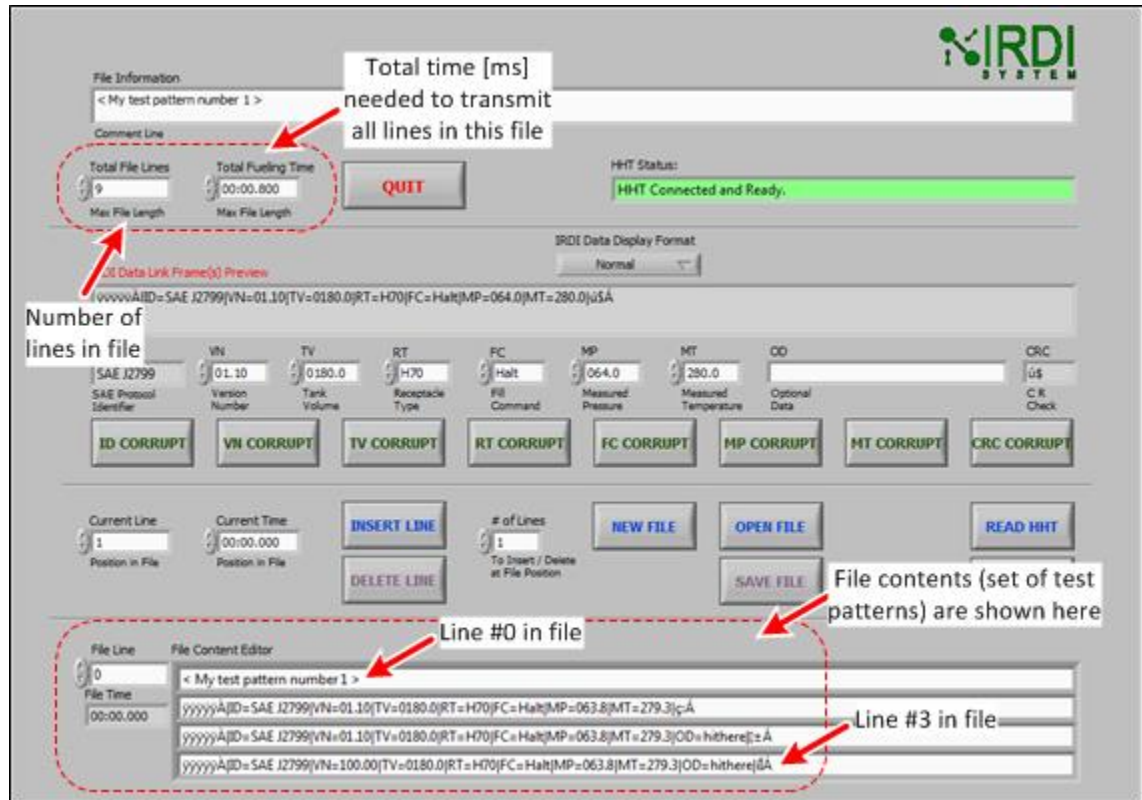


FIGURE 5-5 HHT TEST PATTERN SOFTWARE – FILE CONTENTS

At the **top left** of the screen, the following is displayed:

- Total file lines – the number of IR packets in the file (each packet is a “line”); and,
- Total fueling time – the time, in milliseconds, that it will take to transmit the contents of the test pattern file.

NOTE: The HHT transmits 1 test pattern line every 100 ms. For example, a test pattern file with 5 lines will take 500 ms, so “Total fueling time” will be “00:00.500”.

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At the **bottom** of the screen, the following is displayed:

- “File content editor” – all lines in the file are shown here, including:
 - Line 0, the “File information” line, which provides a description of the purpose of the test file; and,
 - Line 1 to last line of the file - each line is a single IR test packet. See Section 5.1 for details on how to read an IR packet.

To scroll through the lines in the file, use the “up/down” arrows under “File Line”, or click in the “File Line” field and enter the number of the line you want to view. Figure 5-6 below shows how to look at a specific line – pick the line number to view (e.g. 2), and the first line displayed under “File Content Editor” will be the line you have picked.

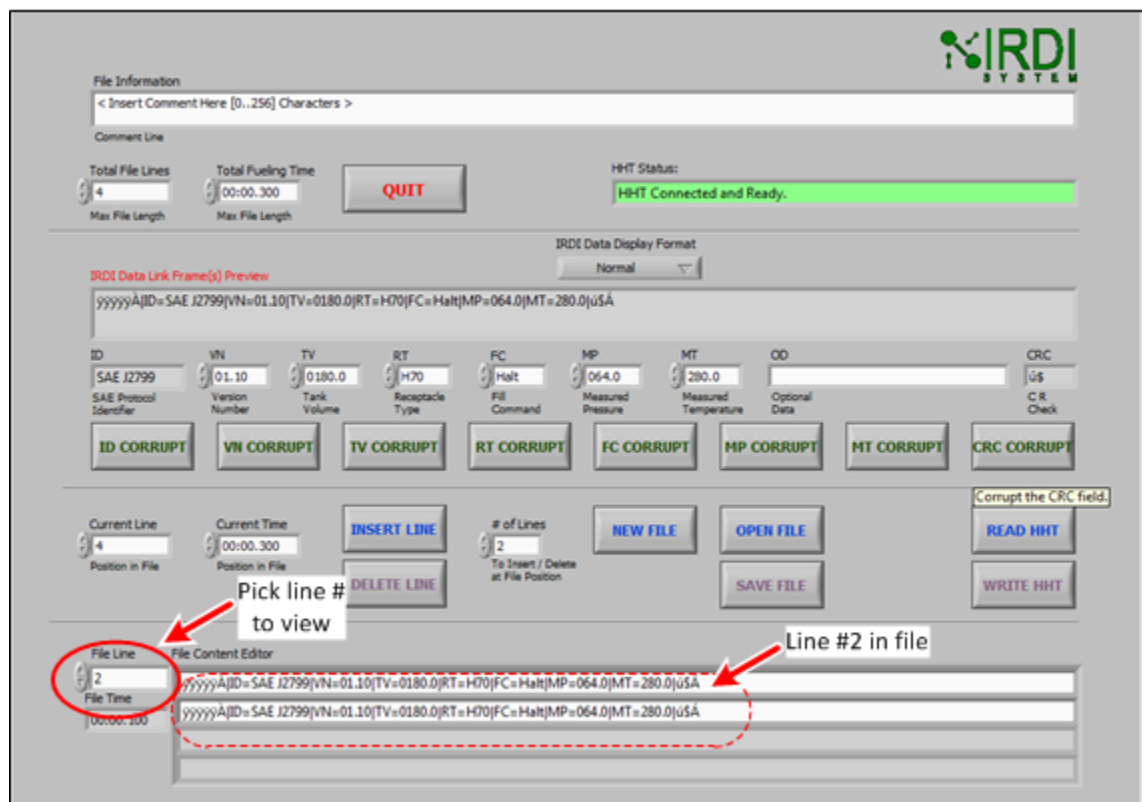


FIGURE 5-6 HHT TEST PATTERN SOFTWARE – VIEWING LINE #2 IN FILE

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5.4 CHANGING THE TEST PATTERN DISPLAY FORMAT

The “IRDI Data Display Format” button allows the user to select one of three formats for viewing the IRDI data message in the “IRDI Data Link Frame” window:

- “Normal”: some special characters are not displayed in this mode; this is the default mode
- “Backslash Codes”: the special characters at the start and end of the IRDI data message are displayed as ASCII codes – e.g. “\FF”
- “Hexadecimal”: all characters in the IRDI data message are displayed as hexadecimal values

Selecting the IRDI Data Display Format

The “IRDI Data Display Format” button is near the top of the screen, as shown in the following figure:

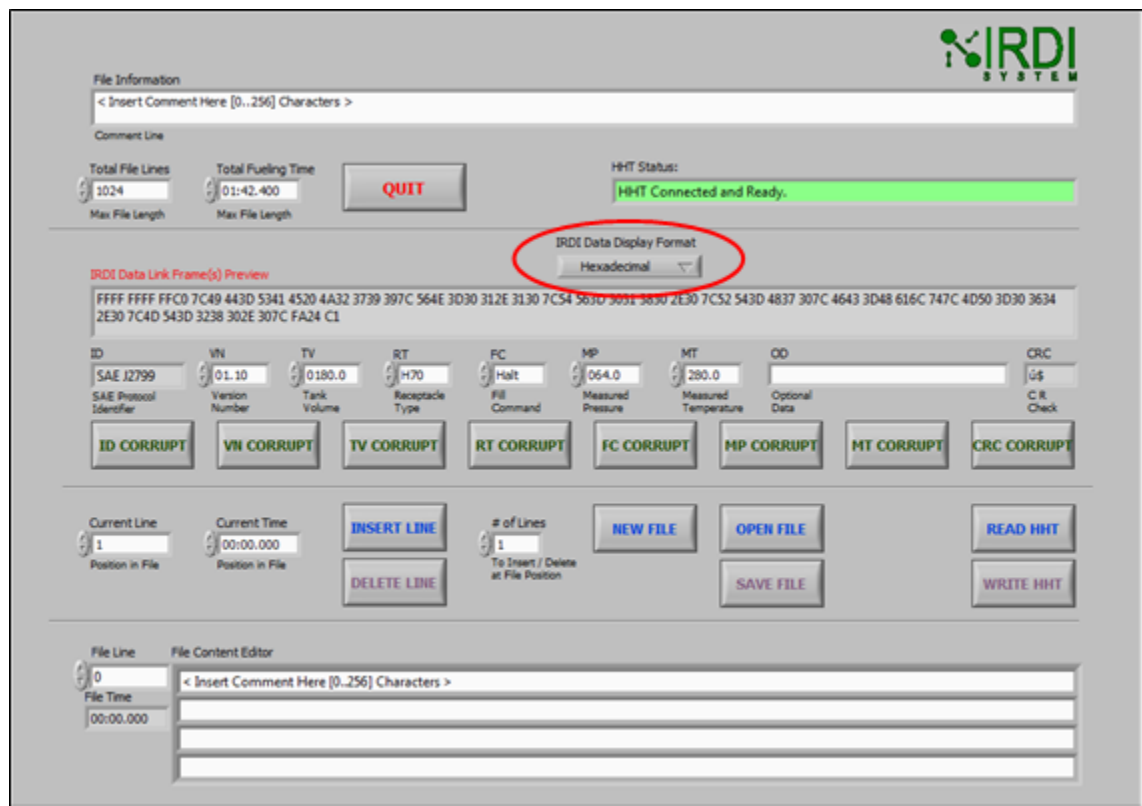


FIGURE 5-7: HHT TEST PATTERN SOFTWARE - IRDI DATA DISPLAY FORMAT

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To select a data display mode, click on the “IRDI Data Display Format” button to see the pull-down menu of options.

Using Normal Format

The “Normal” format is the default format.

When the “Normal” display format is selected, the special characters at the start and end of the IRDI data message cannot be displayed as standard characters – instead, they are shown as special ASCII characters.

Using Backslash Codes Format

When the “Backslash Codes” display format is selected, the special characters at the start and end of the IRDI data message are displayed as ASCII codes:

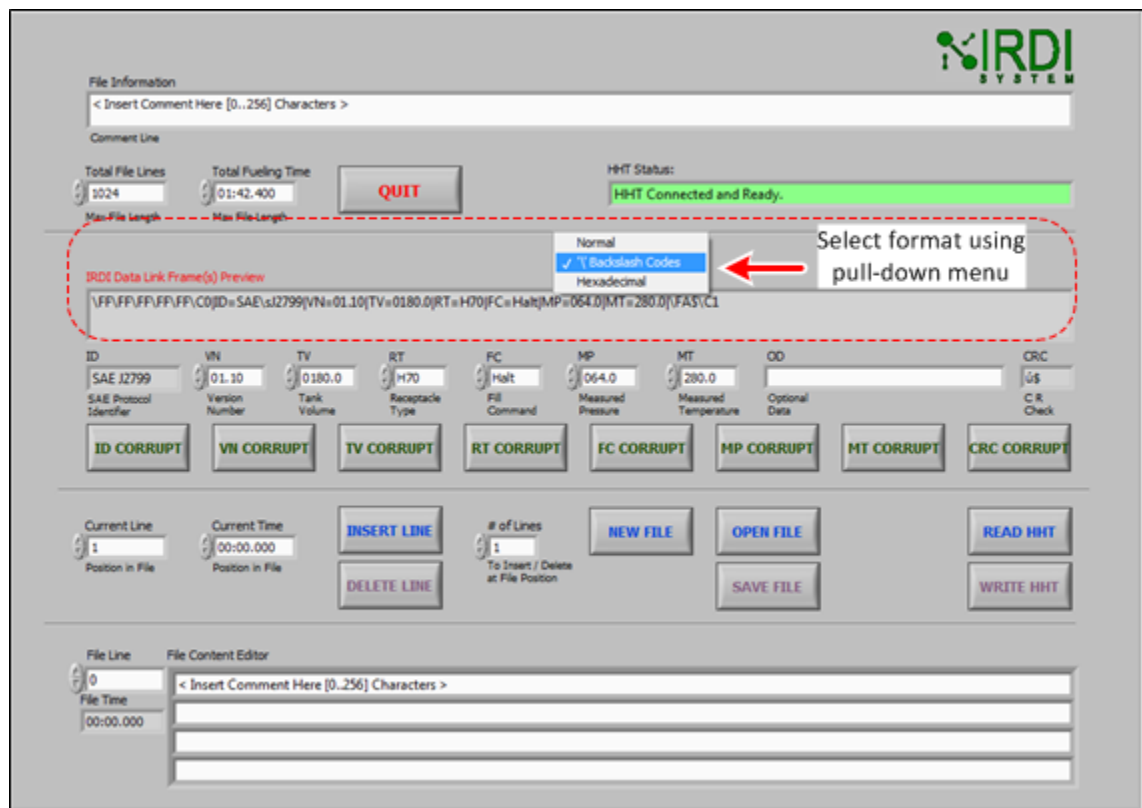


FIGURE 5-8: HHT TEST PATTERN SOFTWARE – BACKSLASH FORMAT

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Using Hexadecimal Format

When the “Hexadecimal” display format is selected, all the characters in the IRDI data message are displayed in hexadecimal format:

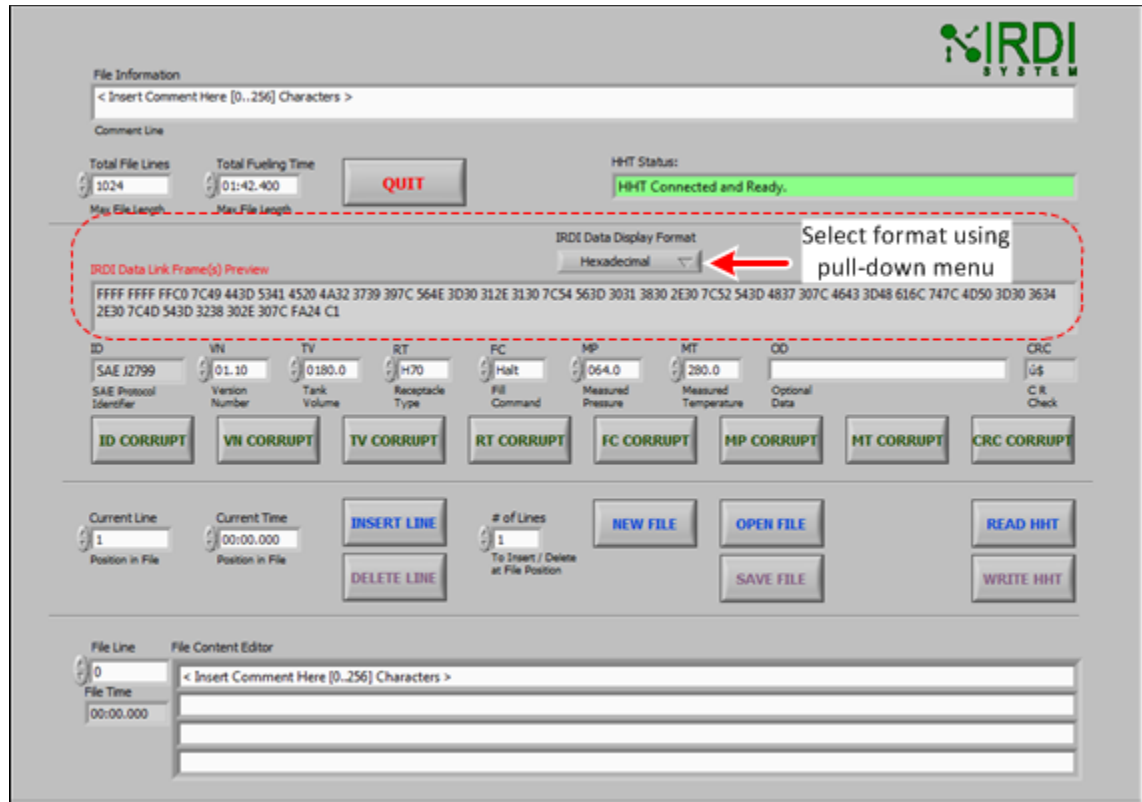


FIGURE 5-9: HHT TEST PATTERN SOFTWARE – HEXADECIMAL FORMAT

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5.5 CREATING A NEW TEST PATTERN FILE

To create a new user-defined test pattern file, do the following:

Action	
STEP 1	Open a new file.
STEP 2	Create and add test pattern lines (IR packets) to the file.
STEP 3	Add file information (e.g. a title or description)
STEP 4	Save the file under a file name.

Each of these steps is described in detail in the following subsections:

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5.5.1 Creating a New File

To create a new file, do the following:

Action	
STEP 1	Click on the “NEW FILE” button.
STEP 2	A warning message will appear as shown in Figure 5-10 – click “OK” in the popup window, to continue.
STEP 3	The screen will now appear as shown in Figure 5-11.

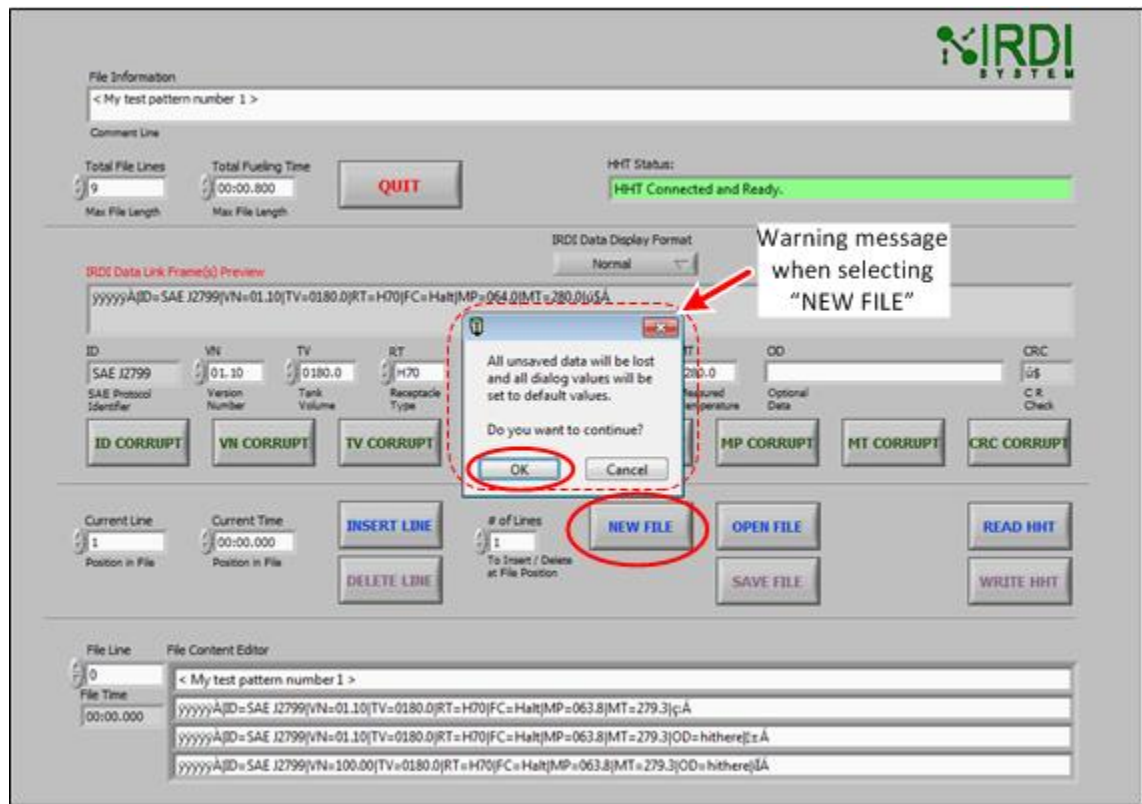


FIGURE 5-10 HHT TEST PATTERN SOFTWARE - NEW FILE WARNING

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The following figure shows the screen at the start of creating a new test file:

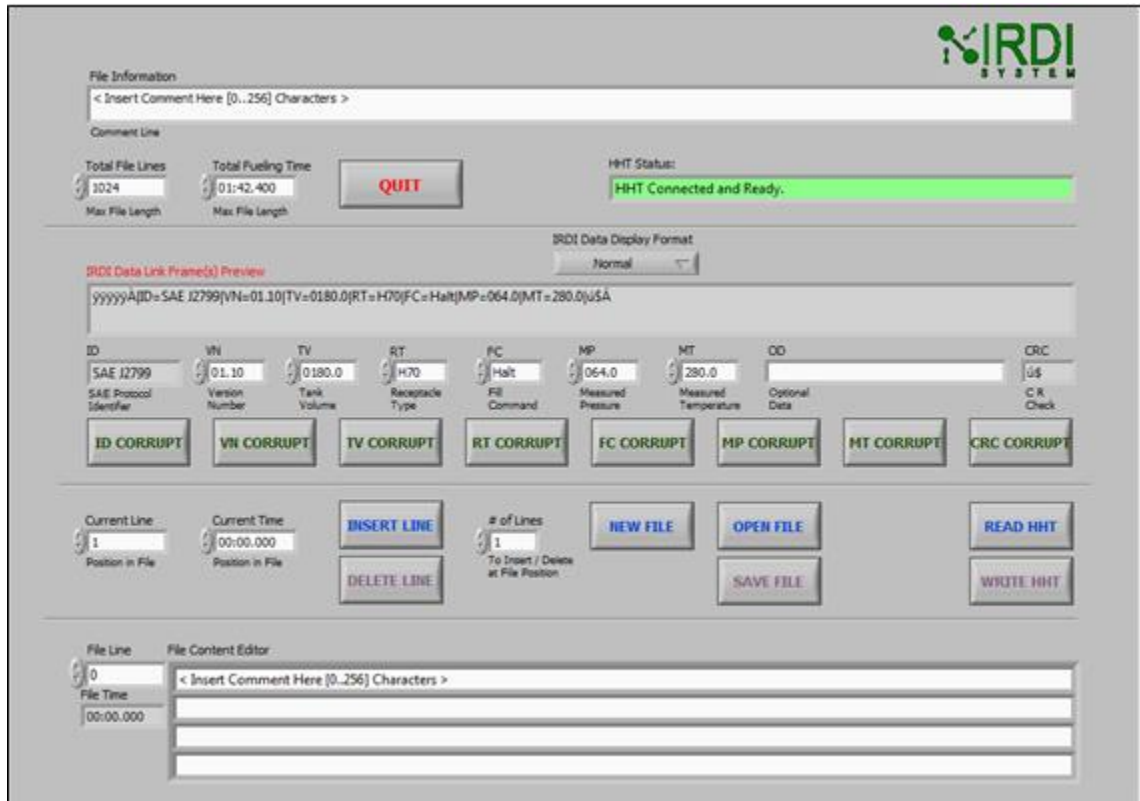


FIGURE 5-11 HHT TEST PATTERN SOFTWARE – STARTING A NEW FILE

5.5.2 Setting the Maximum File Length

To restrict the overall size of the test pattern file, manually enter the total number of file lines that the file can contain (the default value is 1024 lines).

NOTE: The “Total File Lines” value includes the “File Information” line.

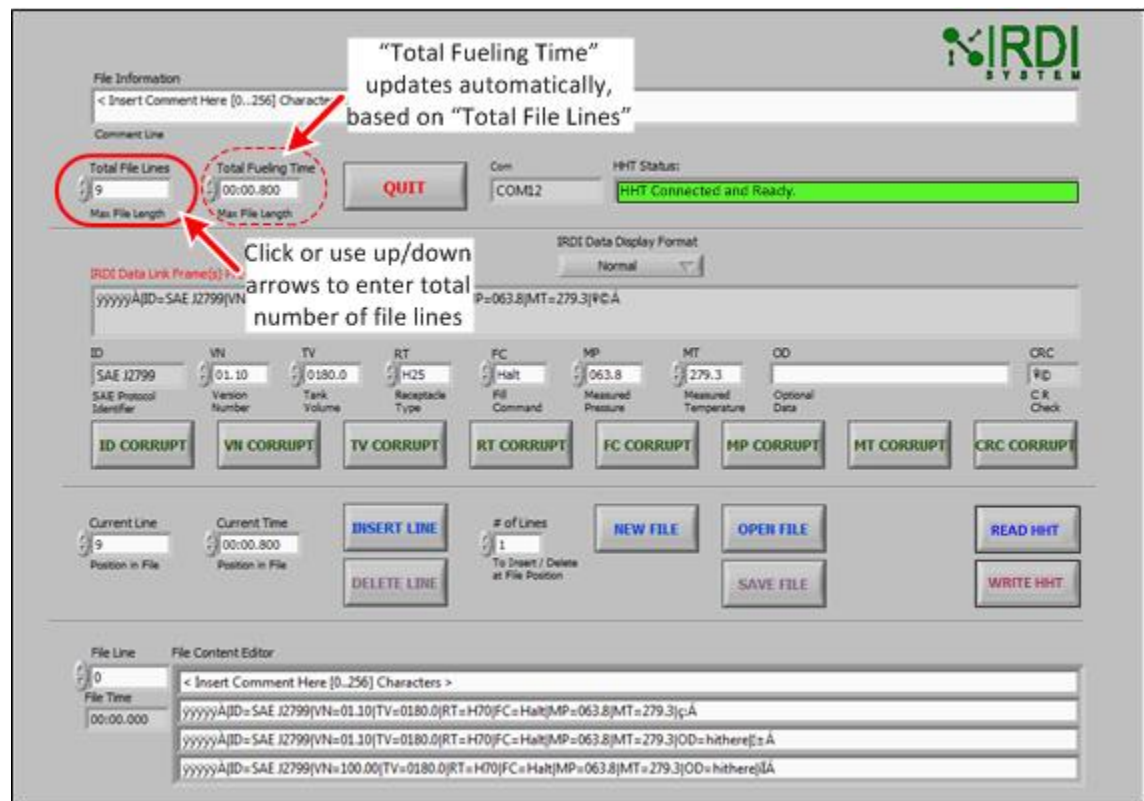


FIGURE 5-12 HHT TEST PATTERN SOFTWARE – TOTAL FILE LINES

To set the maximum number of file lines, do the following:

Action	
STEP 1	Click in the “Total File Lines” window at the top left of the screen, and enter the total number of file lines, or use the “up/down” arrows beside this field to set the numbe of files lines – see Figure 5-12 above.

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Action	
STEP 2	View the “Total Fueling Time” value to the right of the “Total File Lines” field – this value updates automatically, based on the number of file lines, to indicate the total time needed (in milliseconds) to transmit the test pattern lines in this file. For example, a file with 9 file lines will have a “Total Fueling Time” of 900 ms, or 100 ms per line.

5.5.3 Creating and Adding Test Pattern Lines

The user can create unique test pattern lines by changing the values of the “VN”, “TV”, “RT”, “FC”, “MP”, “MT” and/or “OD” message fields manually.

To create a new test pattern line, do the following (refer to Figure 5-13):

Action	
STEP 1	Select the desired values for each of the message fields (see the following subsections for details on each message field).
STEP 2	View the test pattern in the “IRDI Data Link Frame” window, to make sure that it is correct.
STEP 3	Click in the “# of Lines” field, and enter the number of copies of the line that you wish to add to the file.
STEP 4	Click in the “File Line” field and enter the file line at which you want to insert the new line(s), or use the “up/down” arrows next to “File Line” to enter the file line.
STEP 5	Click on the “INSERT LINE” button to add the line or lines to the test pattern file – see Figure 5-13 above.

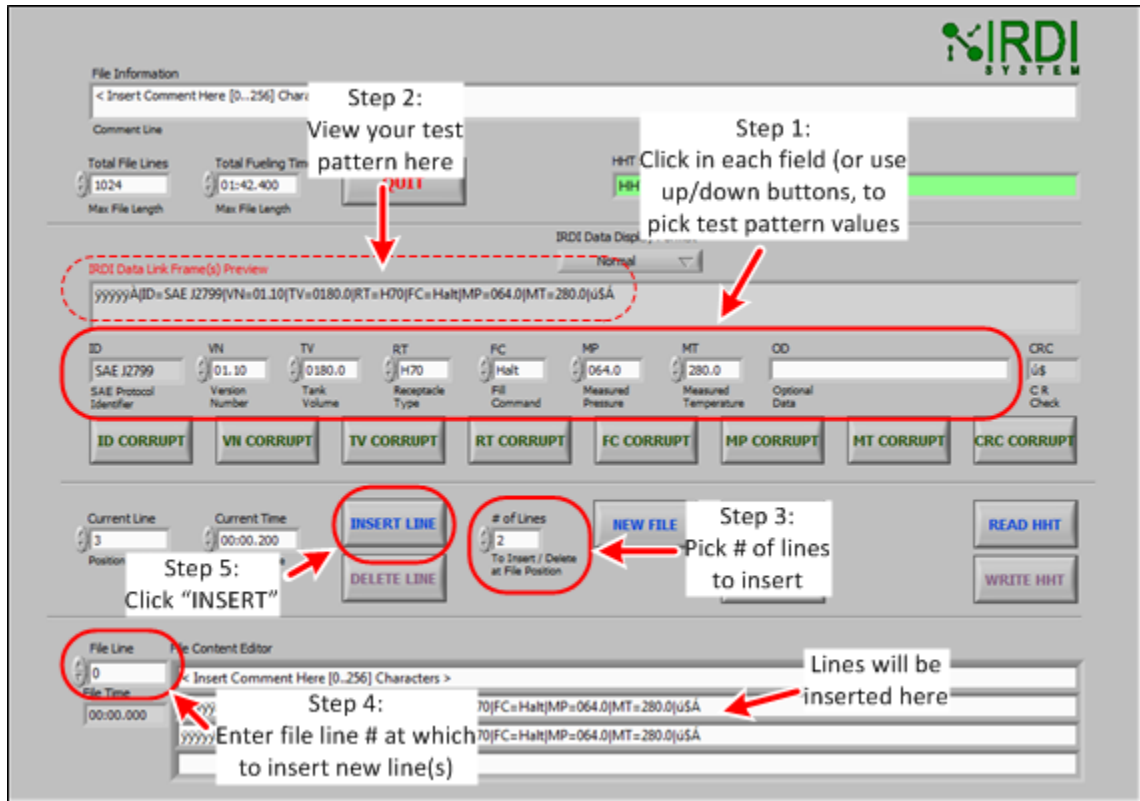
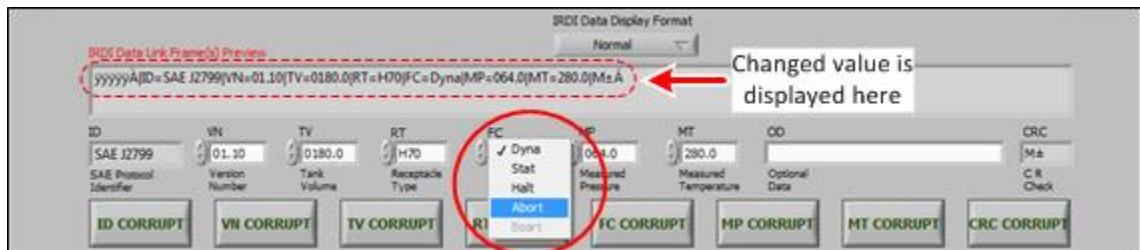


FIGURE 5-13 HHT TEST PATTERN SOFTWARE – CREATING TEST PATTERN LINES

The following shows an example of changing the “FC” field – the selected value, “Dyna”, is displayed as part of the test pattern line in the “IRDI Data Link Frame” window:



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The following sub-sections provide details on how to change the value of each field in the test pattern:

Changing the “VN” Value

To change the “VN” (version number) value manually, do the following:

Action	
STEP 1	Click on the “VN” window and use the keyboard to enter a new value OR click on the “up” or “down” arrows to the left of the “VN” window, to change the version number value in the infrared data message. (see below)
NOTES	The user must include the decimal place when entering a value in the window. Each “up” or “down” arrow click will increment or decrement the “VN” value by 0.01.

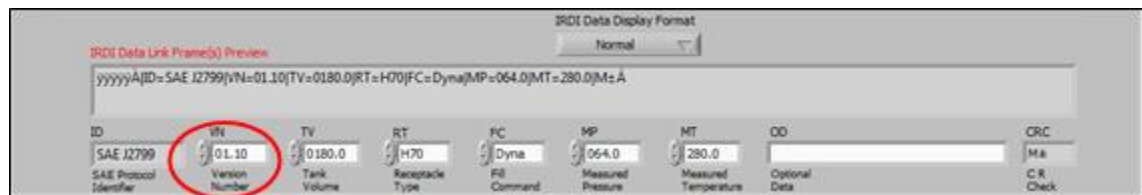


FIGURE 5-14: HHT TEST PATTERN SOFTWARE – VERSION NUMBER INPUT

Changing the “RT” Value

To change the “RT” (receptacle type) value manually, do the following:

Action	
STEP 1	Click on the “RT” window to get a pull-down menu of options (see below), or click on the “up” and “down” arrows to the left of the “RT” window to scroll through the options.
STEP 2	Select one of the available RT values (“H25”, “H35”, “H50” or “H70”) to change the receptacle type value in the infrared data message.

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FIGURE 5-15: HHT TEST PATTERN SOFTWARE - RECEPTACLE TYPE INPUT

Changing the “TV” Value

To change the “TV” (tank volume) value manually, do the following:

Action	
STEP 1	Click on the “TV” window and use the keyboard to enter a new value OR click on the “up” or “down” arrows to the left of the “TV” window, to change the tank volume value in the infrared data message. (see below)
NOTES	The user must include the decimal place when entering a value in the window. Each “up” or “down” arrow click will increment or decrement the “TV” value by 1.0. If the user enters a fractional number, the value will be automatically rounded to the nearest whole number.

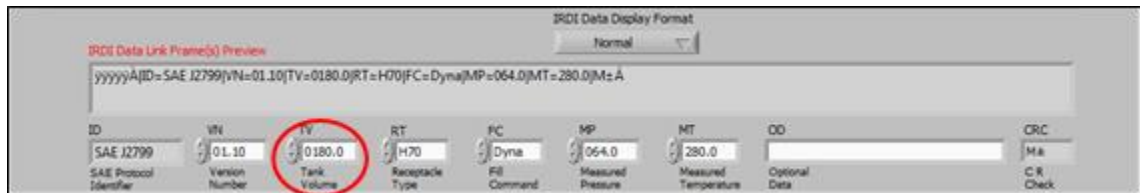


FIGURE 5-16: HHT TEST PATTERN SOFTWARE - TANK VOLUME INPUT

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Changing the “FC” Value

To change the “FC” (fill command) value manually, do the following:

Action	
STEP 1	Click on the “FC” window to get a pull-down menu of options (see below), or click on the “up” and “down” arrows to the left of the “FC” window to scroll through the options.
STEP 2	Select one of the available fill commands (“DYNA”, “STAT”, “HALT” or “ABORT”) to change the fill command value in the infrared data message.

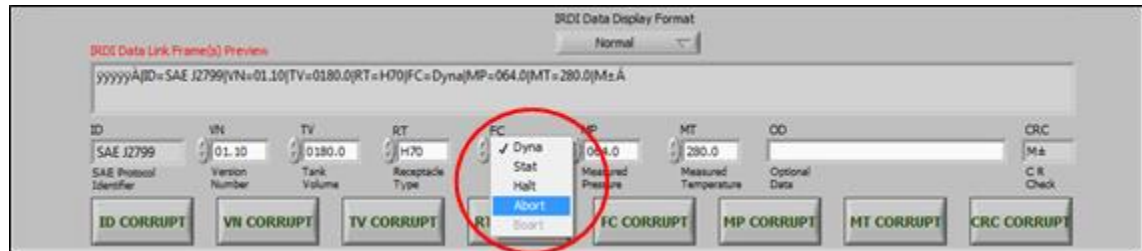


FIGURE 5-17: HHT TEST PATTERN SOFTWARE - FILL COMMAND INPUT

Changing the Measured Pressure “MP” Value

To change the pressure sensor value manually, do the following:

Action	
STEP 1	Click on the “MP” window and use the keyboard to enter a new value OR click on the “up” or “down” arrows to the left of the “MP” window, to change the tank volume value in the infrared data message. (see below)
NOTES	The user must include the decimal place when entering a value in the window. Each “up” or “down” arrow click will increment or decrement the “MP” value by 0.1.

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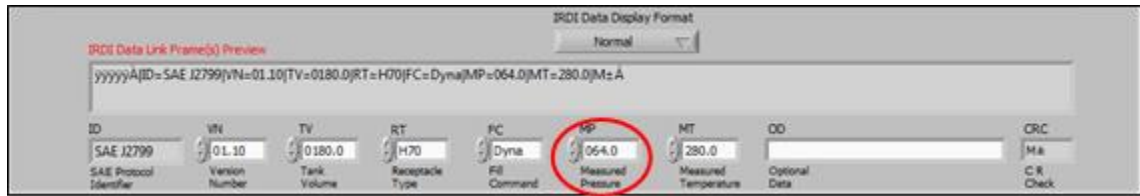


FIGURE 5-18 HHT TEST PATTERN SOFTWARE - PRESSURE INPUT

Changing the Measured Temperature “MT” Value

To change the temperature sensor value manually, do the following:

Action	
STEP 1	Click on the “MT” window and use the keyboard to enter a new value OR click on the “up” or “down” arrows to the left of the “MT” window.
NOTES	The user must include the decimal place when entering a value in the window. Each “up” or “down” arrow click will increment or decrement the “MT” value by 0.1.

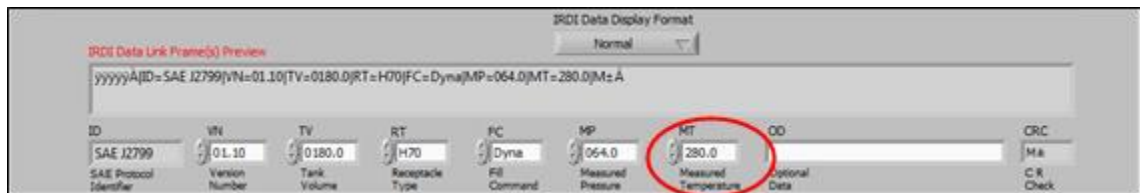


FIGURE 5-19 HHT TEST PATTERN SOFTWARE - TEMPERATURE INPUT

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Changing the Optional Data (“OD”) Value

To change the optional data (“OD”) value manually, do the following:

Action	
STEP 1	<p>Click on the “OD” display window and use the keyboard to enter a new value (see below).</p> <p>As an example, if the user wants to transmit three parameters, “A”, “B” and “C”, with values 1, 2, and 3 respectively, the user can enter “A=1;B=2;C=3”, or “A1B2C3”, or some other similar format, in the “OD” display window. The data format for the “OD” data is defined by the user.</p>
NOTES	<p>The user may enter up to 16 characters. If more than 16 characters are entered, the characters will be truncated automatically.</p> <p>The user may not use the character “ ” (ASCII), or “\$7C” (hexadecimal)</p>

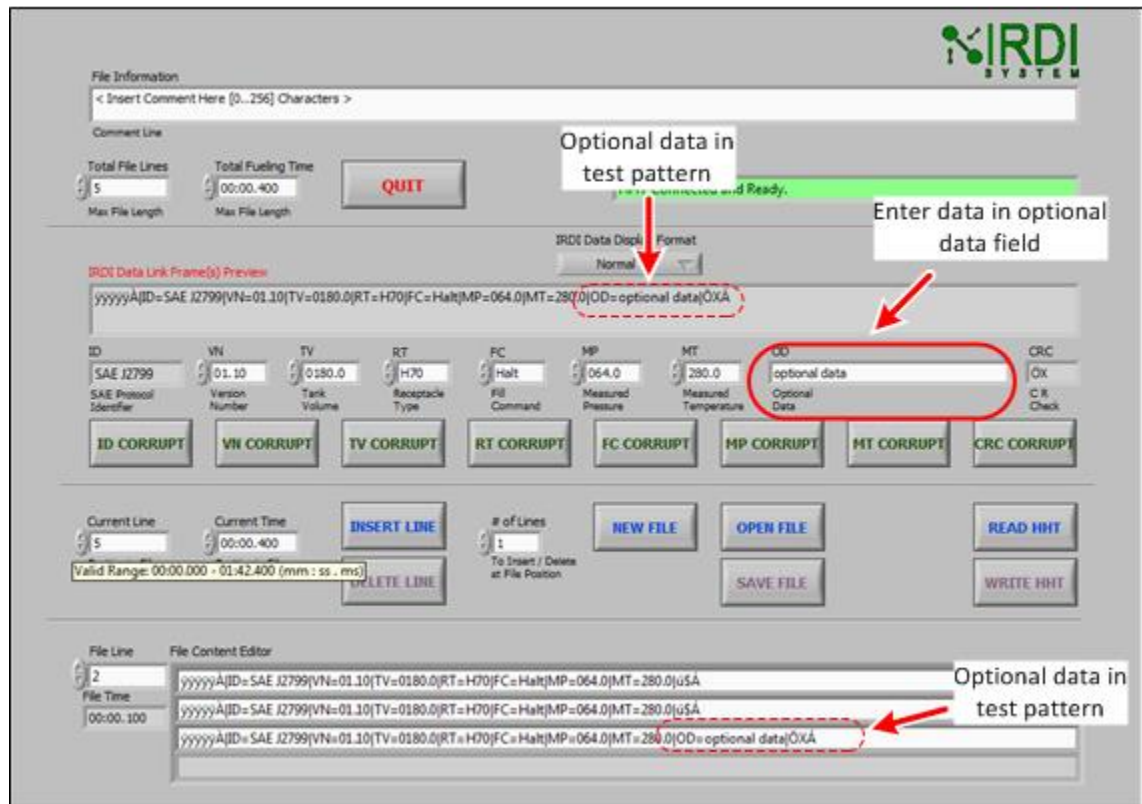


FIGURE 5-20 HHT TEST PATTERN SOFTWARE – OPTIONAL DATA INPUT

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5.5.4 Deleting Test Pattern Lines

To delete one or more test pattern lines, do the following:

Action	
STEP 1	Click in the “# of Lines” field, and enter the number of lines that you wish to delete from the file – see Figure 5-21.
STEP 2	Click in the “File Line” field and enter the file line at which you want to delete line(s), or use the “up/down” arrows next to “File Line” to enter the file line.
STEP 3	Click on the “DELETE LINE” button to delete the line or lines from the test pattern file.
STEP 4	View the file contents under “File Content Editor”, to make sure that the correct lines have been deleted – see Figure 5-22.

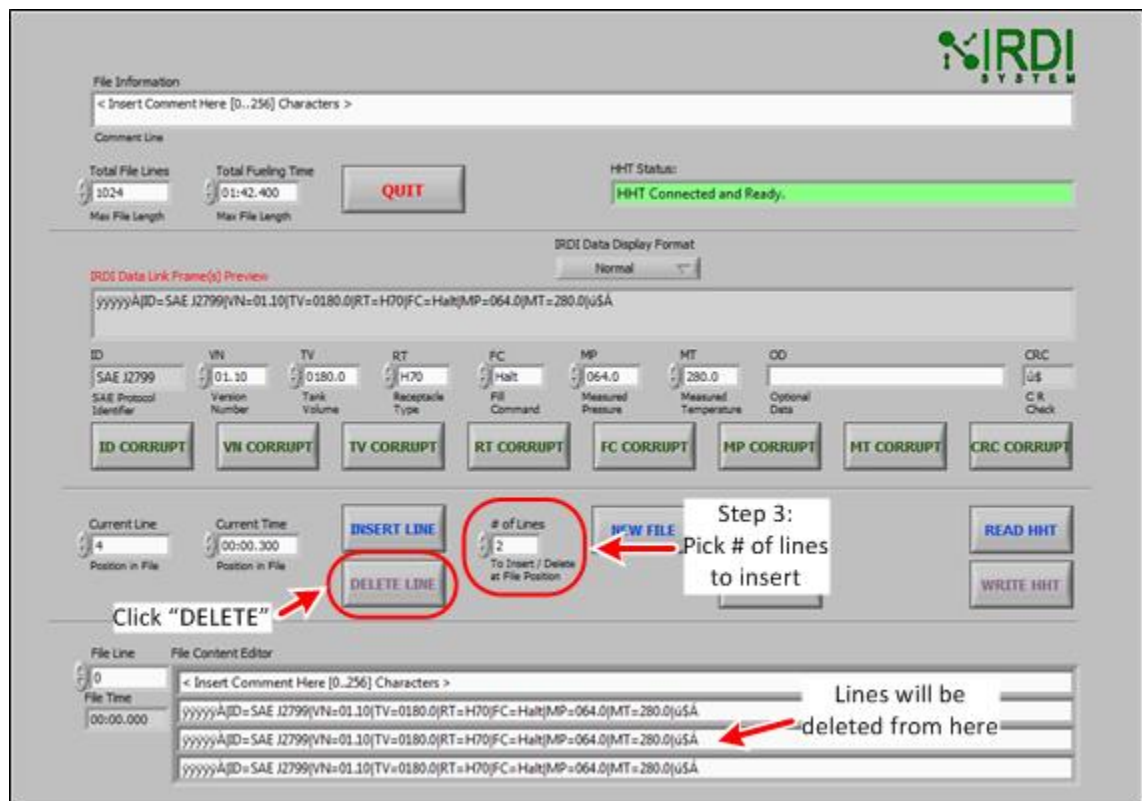


FIGURE 5-21 HHT TEST PATTERN SOFTWARE – SELECTING # OF LINES TO DELETE

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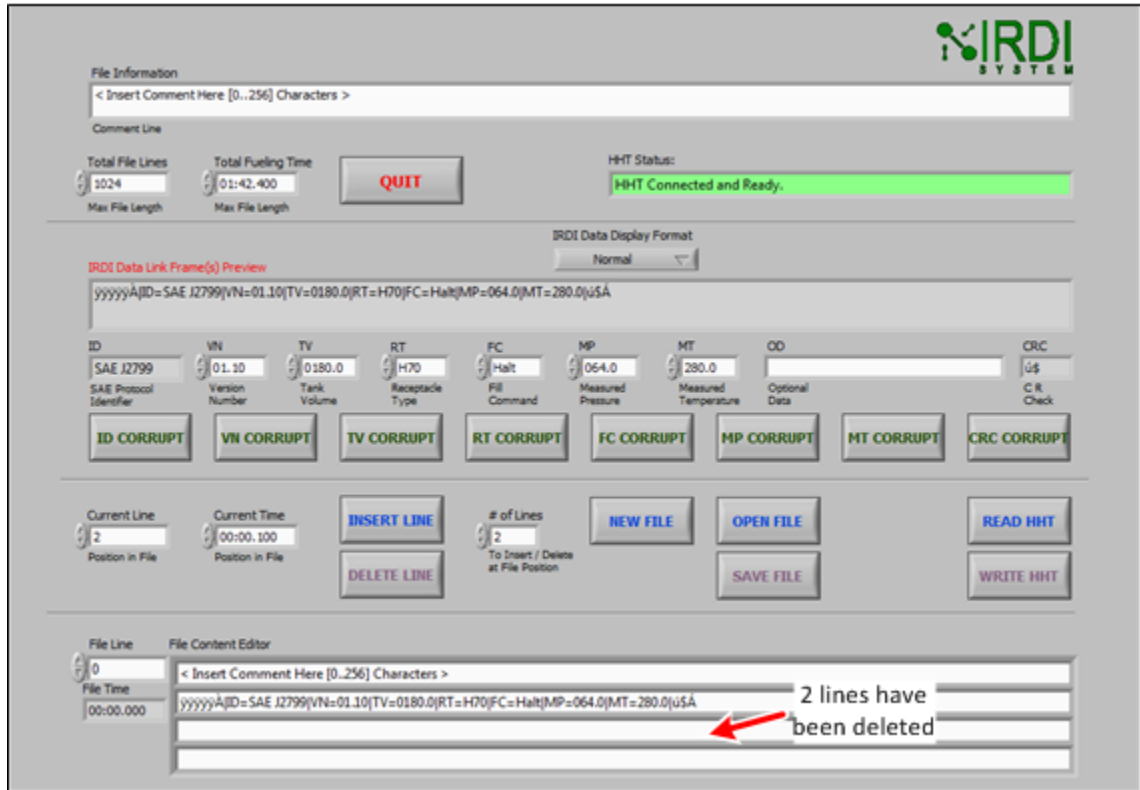


FIGURE 5-22 HHT TEST PATTERN SOFTWARE – LINES DELETED

5.5.5 Creating and Adding a Corrupted Test Pattern Line

Each field in the data message can be “corrupted”, in order to test the hydrogen station’s ability to detect and react to issues of data corruption in the IRDI data message. The message fields may be corrupted using the corresponding “**corrupt**” buttons.

The following fields can be “corrupted”:

- ID field;
- VN field (version);
- TV field (tank volume);
- RT field (receptacle type);
- FC field (fill command);

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- MP field (measured pressure);
- MT field (measured temperature); and,
- CRC field (cyclic redundancy check – used to check for errors in the message).

When a field is “corrupted”, its current value is replaced with the invalid value shown in the following table:

TABLE 5-2: INVALID (CORRUPT) DATA VALUES

Data Field	SAE J2799 Tag	Valid Data Values (in range)	Preset Invalid (Corrupt) Data Value
Protocol Identifier	ID=	SAE J2799	SAE J2779
Data Communications Software Version Number	VN=	00.00 to 99.99	100.00
Tank Volume	TV=	0000.0 to 5000.0	6000.0
Receptacle Type	RT=	H25, H35, H50, H70	H35
Fueling Command	FC=	Dyna, Stat, Halt, Abort	Boart
Measured Pressure	MP=	000.0 to 100.0	110.0
Measured Temperature	MT=	16.0 to 425.0	999.9
CRC			\$ú

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Figure 5-23 shows an example of corrupting the “TV” field:

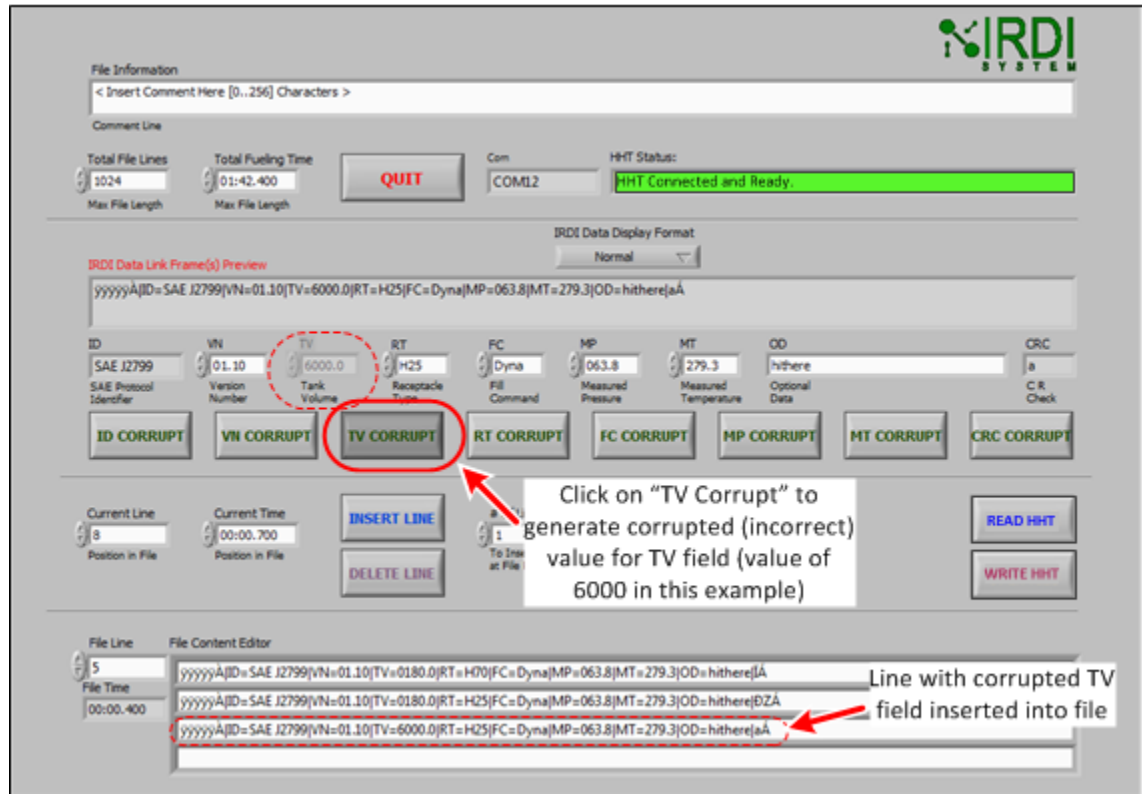


FIGURE 5-23 HHT TEST PATTERN SOFTWARE – CORRUPTING A TEST PATTERN

As an example, to corrupt the “TV” field (see above figure), do the following:

Action	
STEP 1	Click on the “TV CORRUP'T” button. Note that the “TV” field in the “IR Data Link” window now shows an invalid (or corrupt) value of “6000.0”, and the “TV CORRUP'T” button becomes a darker grey shade.
STEP 2	Click on the “INSERT LINE” button, to insert this line, with the corrupted “TV” value, into the file – this line is now shown as a new line under “File Content Editor”.
STEP 3	Click on the “TV CORRUP'T” button again, to turn off the corruption of the “TV” field. The button now changes from darker grey to lighter grey, indicating that the “TV” field has resumed allowing only valid values.

5.5.6 Adding File Information

Each test pattern file includes, as its first line (line number zero), a text-based “File information” field, which can be used to name and/or describe the test pattern file.

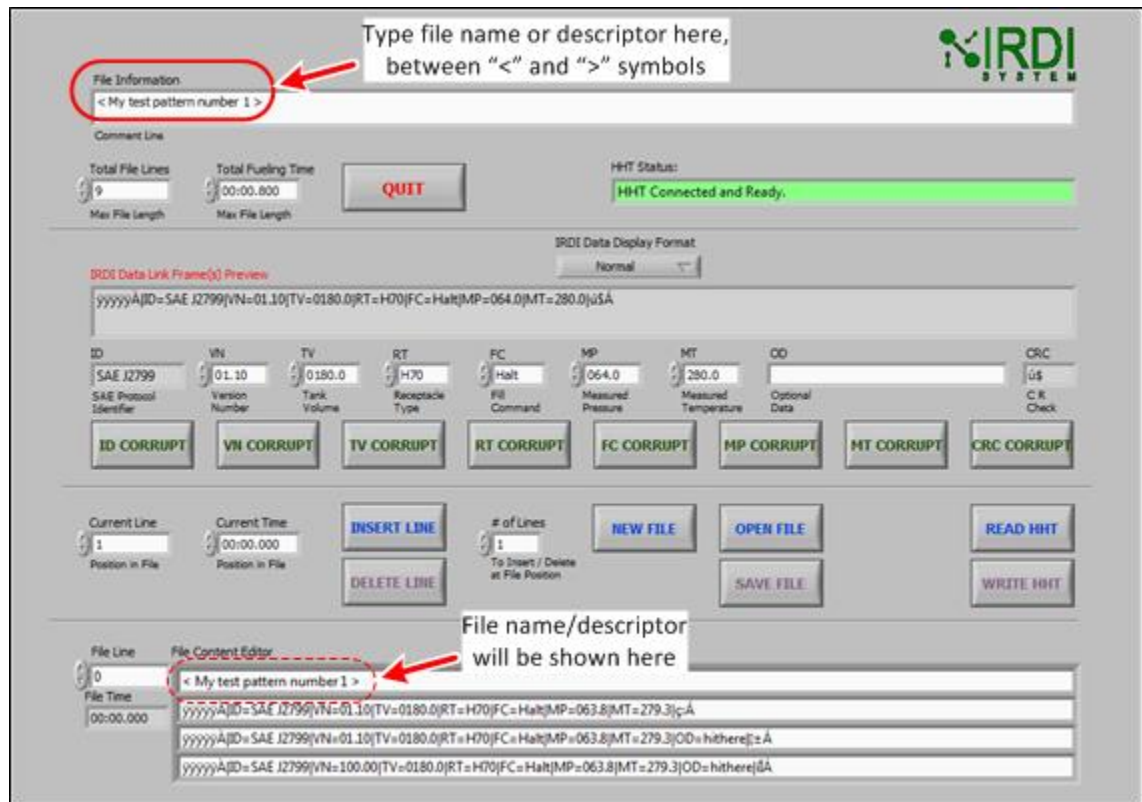


FIGURE 5-24 HHT TEST PATTERN SOFTWARE – FILE INFORMATION

To add file information, do the following:

Action	
STEP 1	Click in the “File Information” window at the top left of the screen. Enter a name or description, between the “<” and “>” symbols. NOTE: Leave the “<” and “>” symbols in place, as they are required for delimiting the line.
STEP 2	View file line zero under “File Content Editor”, at the bottom of the screen. The information you entered should be displayed on line zero.

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5.5.7 Saving the Test Pattern File

Once the test pattern lines are defined, along with the “File Information” and the number of file lines, **save the test pattern** with a user-defined file name.

To save the file, do the following:

Action	
STEP 1	Click on the “SAVE FILE” button.
STEP 2	A browser window will appear -- see the following figure. Browse to the directory where you want to store the file.
STEP 3	In the “File Name” field of the browser window, enter the file name you want to use for this test pattern file.
STEP 4	Click on the “OK” button to save the file.

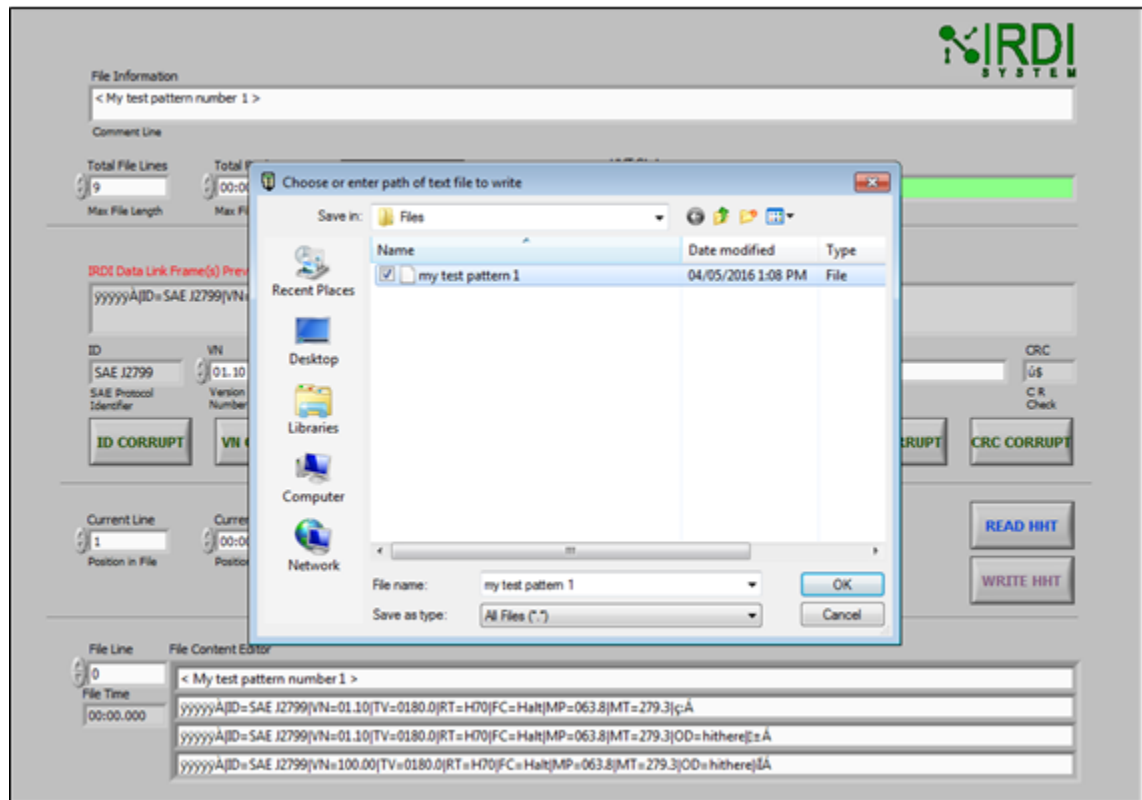


FIGURE 5-25 HHT TEST PATTERN SOFTWARE – SAVING THE FILE

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5.6 PROGRAMMING THE HHT WITH A TEST PATTERN FILE

To program the HHT with a test pattern file, do the following:

Action	
STEP 1	Open or create a test pattern file.
STEP 2	Click on the “WRITE HHT” button.
STEP 3	<p>A popup window will appear - – under “File”, enter the number of the file (1 through 4) to write this test pattern file to, or use the “up/down” arrows to pick the file number, then click “OK”.</p> <p>NOTE: The file number corresponds to test patterns 1 through 4. For example, if you program file number 4, you must then select “T4” on the HHT to transmit that test pattern.</p>

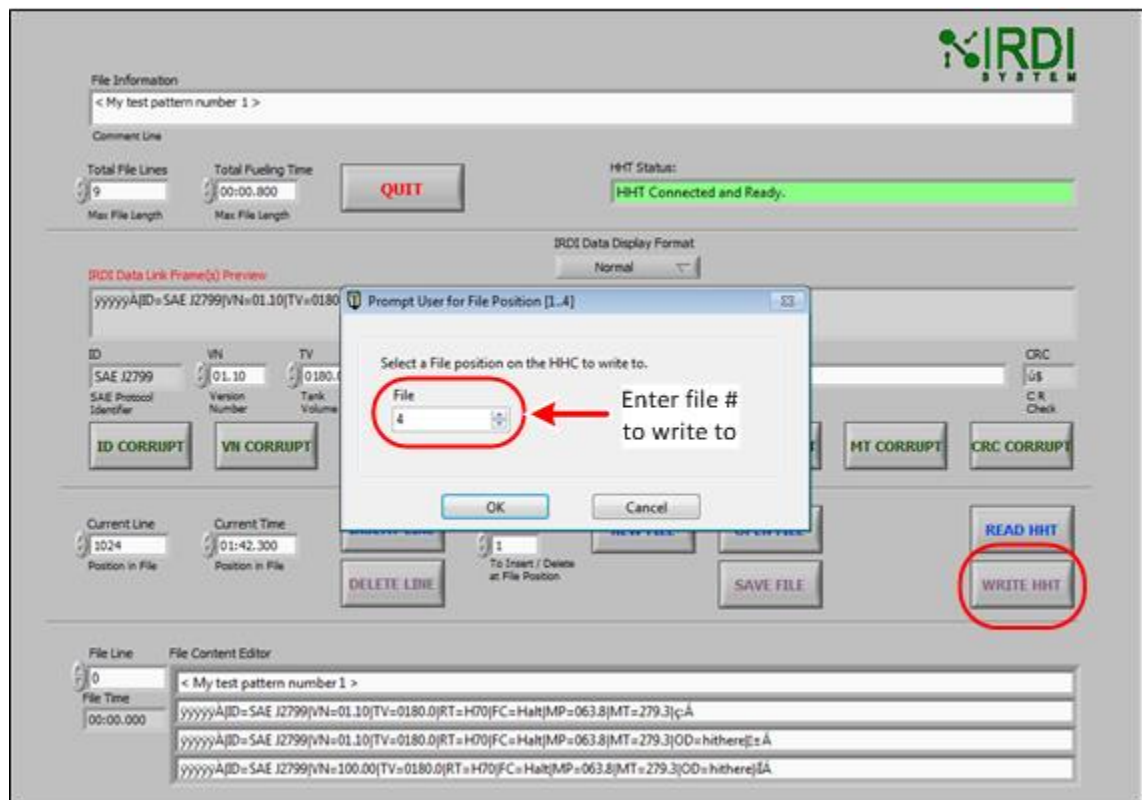


FIGURE 5-26 HHT TEST PATTERN SOFTWARE – WRITE TO HHT

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Action	
STEP 4	<p>In the “HHT Status” window, the message “Writing data to HHT. Please wait.” will be displayed – see figure below.</p> <p>Wait while the HHT is programmed.</p> <p>The “HHT Status” message will return to “HHT Connected and Ready.” when the HHT programming is completed.</p>

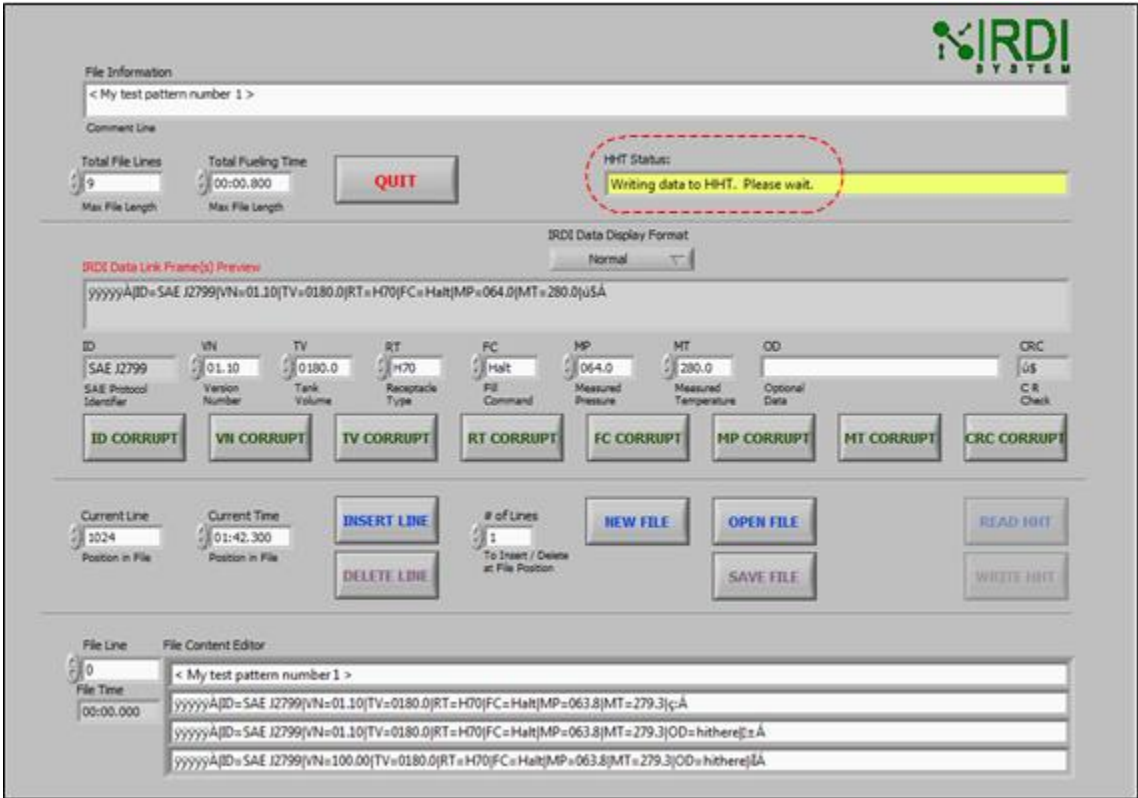


FIGURE 5-27 HHT TEST PATTERN SOFTWARE – HHT PROGRAMMING IN PROGRESS

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5.7 READING A TEST PATTERN FILE FROM THE HHT

To read the HHT's current test pattern files, do the following:

Action	
STEP 1	Click on the “READ HHT” button.
STEP 2	<p>A popup window will appear -- under “File”, enter the number of the file (1 through 4) to read from the HHT, or use the “up/down” arrows to pick the file number, then click “OK”.</p> <p>NOTE: The file number corresponds to test patterns 1 through 4. For example, file number 4 is accessed on the HHT by selecting “T4”.</p>

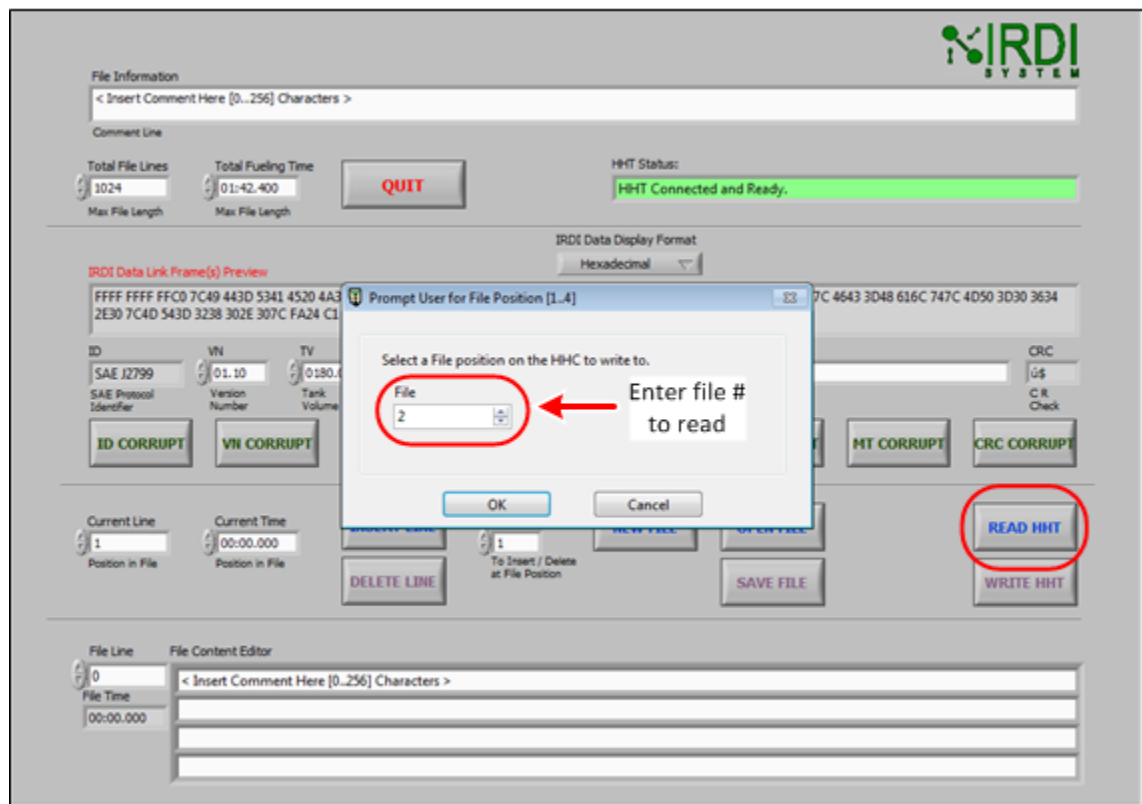


FIGURE 5-28 HHT TEST PATTERN SOFTWARE – READ FROM HHT

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Action	
STEP 3	<p>In the “HHT Status” window, the message “Reading data from HHT. Please wait.” will be displayed – see figure below.</p> <p>Wait while the HHT is being read.</p> <p>The “HHT Status” message will return to “HHT Connected and Ready.” when the reading from the HHT is completed.</p>

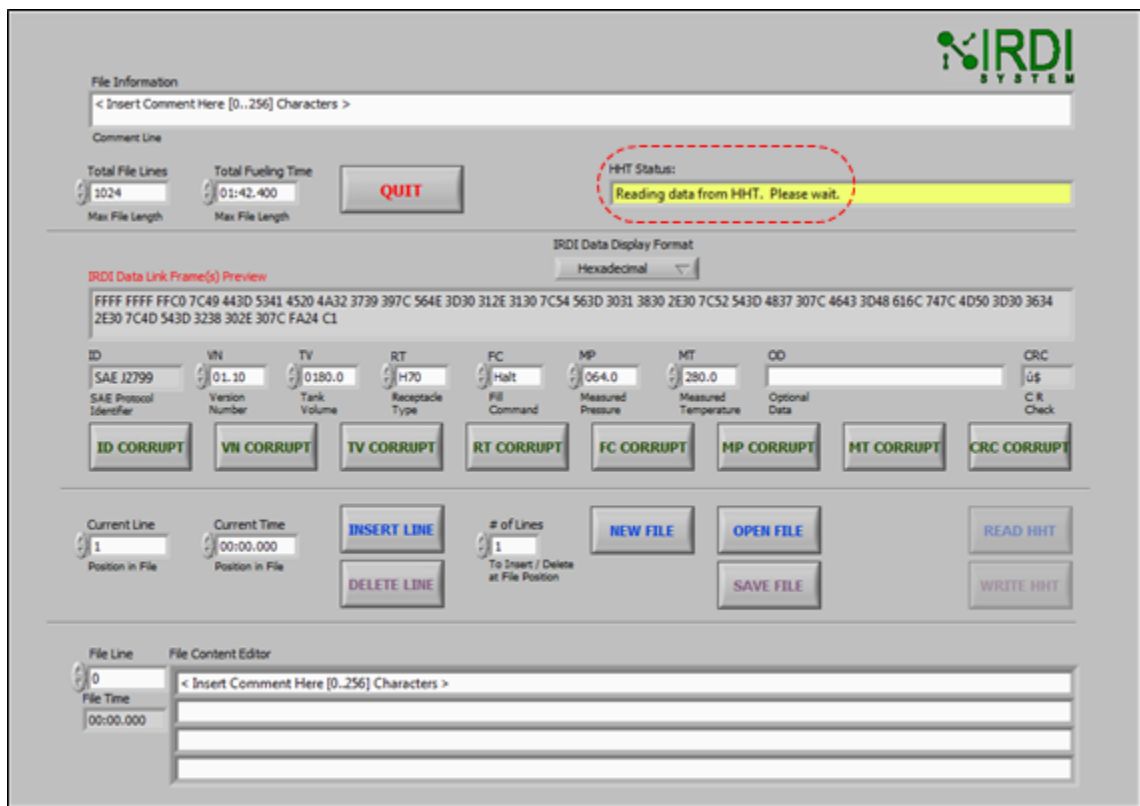


FIGURE 5-29 HHT TEST PATTERN SOFTWARE – HHT READING IN PROGRESS

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Action	
STEP 4	View the contents of the file that was read from the HHT – the test pattern lines contained in this file will be shown under “File Content Editor”.

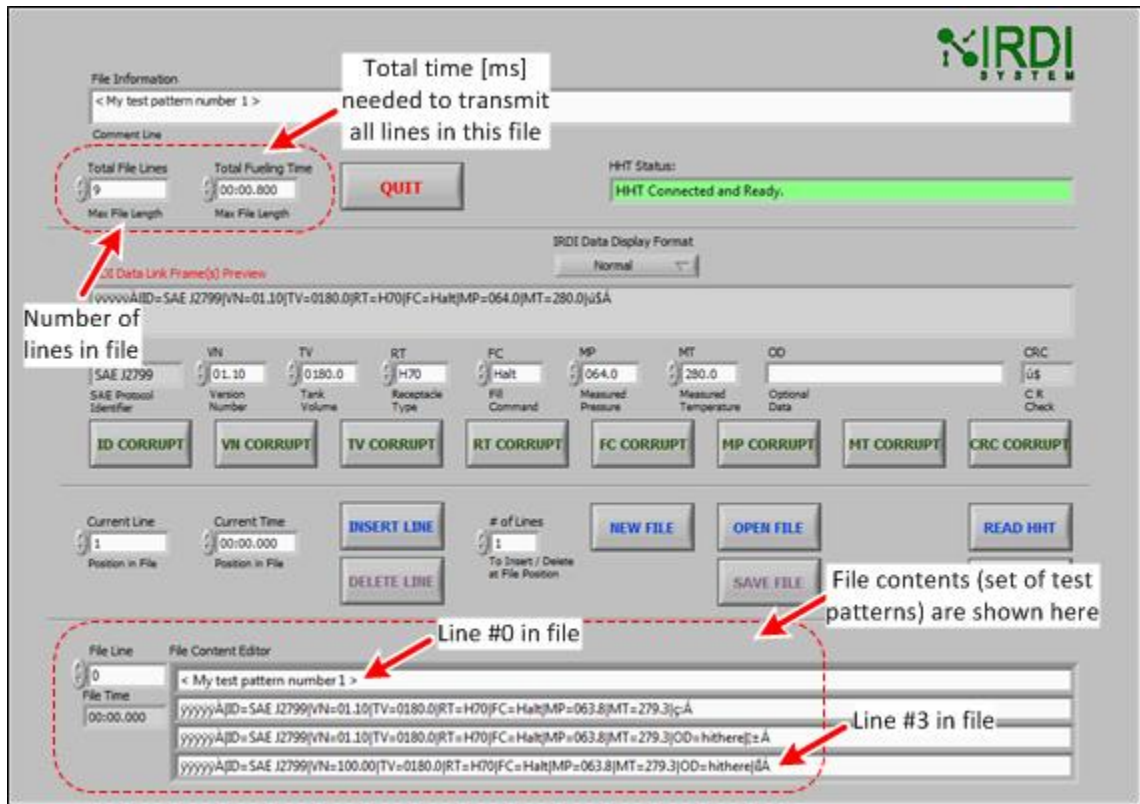


FIGURE 5-30 HHT TEST PATTERN SOFTWARE – HHT TEST PATTERN FILE

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6 TROUBLESHOOTING

This section provides guidance on troubleshooting any issues the user may have when using the HHT or the HHT test pattern software.

6.1 PROBLEM: “POWER” LIGHT NOT TURNING ON

POSSIBLE ROOT CAUSE #1	
	The battery power is too low to allow the HHT to power up.
TROUBLESHOOTING STEPS	
	1. Replace the batteries as per Section 4.2.

6.2 PROBLEM: INFRARED DATA NOT BEING TRANSMITTED/RECEIVED

If the “Power” light is on, but there is no infrared data being transmitted (hydrogen station is not receiving data):

POSSIBLE ROOT CAUSE #1	
	The battery power is too low to allow the transmitter to work.
TROUBLESHOOTING STEPS	
	1. Check the “Battery” light – if the light is on, replace the batteries as per Section 4.2.
POSSIBLE ROOT CAUSE #2	
	Data is not getting from the transmitter to the receiver.
TROUBLESHOOTING STEPS	
	1. Check that the HHT is properly inserted into the end of the nozzle.
	2. Check that the surfaces of the transmitter and receiver are dust-free and not obstructed.

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6.3 PROBLEM: HHT TEST PATTERN SOFTWARE PROGRAM NOT COMMUNICATING

If the “HHT Status” window indicates “Not Connected”:

POSSIBLE ROOT CAUSE #1	
The USB cable is not connected properly.	
TROUBLESHOOTING STEPS	
<ol style="list-style-type: none"> 1. Check that the USB cable is connected properly to the HHT’s USB port, and to a USB port on the computer running the HHT test pattern software. 2. Unplug the USB cable from the computer, and plug it in again – the computer should auto-detect the HHT and automatically set the port number and communications parameters. 3. Quit and restart the HHT test pattern software. 	
POSSIBLE ROOT CAUSE #2	
The HHT is in “sleep” mode.	
TROUBLESHOOTING STEPS	
<ol style="list-style-type: none"> 1. On the HHT test pattern software screen, check the “HHT Status” window – if the message reads “HHT in Sleep Mode.”, the HHT is in a mode that does not allow it to communicate. 2. Alternatively, check the “Power” light on the front of the HHT – if it is off, the HHT is off. 3. Press the “Power” button on the front of the HHT for at least 3 seconds, to turn on the HHT. 4. Make sure that the “Power” light is now on. 5. Run the HHT test pattern software, and recheck the “HHT Status” window – the message should now read “HHT Connected and Ready.”. 	
POSSIBLE ROOT CAUSE #3	
The FTDI drivers were not installed correctly.	
TROUBLESHOOTING STEPS	
<ol style="list-style-type: none"> 1. Re-install the FTDI drivers, as per Appendix B, Programming the Firmware, step 3. 	

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Appendix A: INSTALLING THE HHT TEST PATTERN SOFTWARE

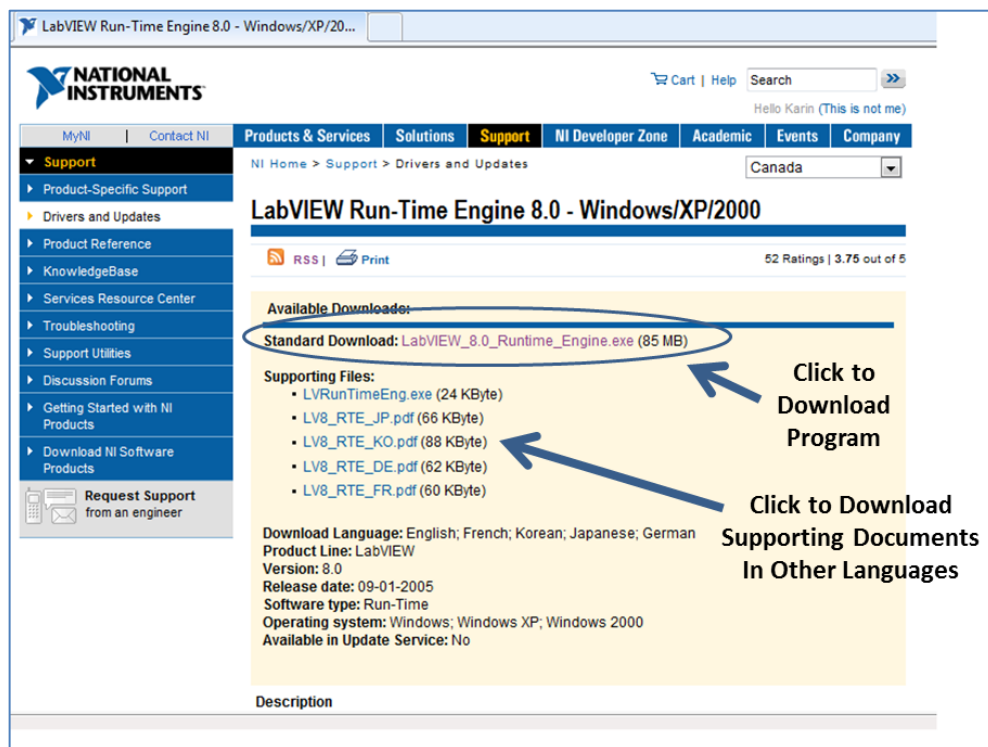
To install the HHT test pattern software, you must first install the LabVIEW Runtime Engine and the LabVIEW NI-VISA Runtime Engine. The following instructions are based on using Windows 7 – the screen appearance may differ slightly for other Windows versions.

INSTALLING THE LABVIEW RUNTIME ENGINE

If you already have LabVIEW Runtime Engine and LabVIEW NI-VISA Runtime Engine installed, go to “Installing the HHT Test Pattern (LabVIEW)” on page 66.

To install the LabVIEW Runtime Engine, do the following:

Action	
STEP 1	Start up the computer.
STEP 2	Go to any browser program and click on or type in the following link: http://joule.ni.com/nidu/cds/view/p/id/704/lang/en Click on the “LabVIEW_x.x_Runtime_Engine.exe” link (see below).

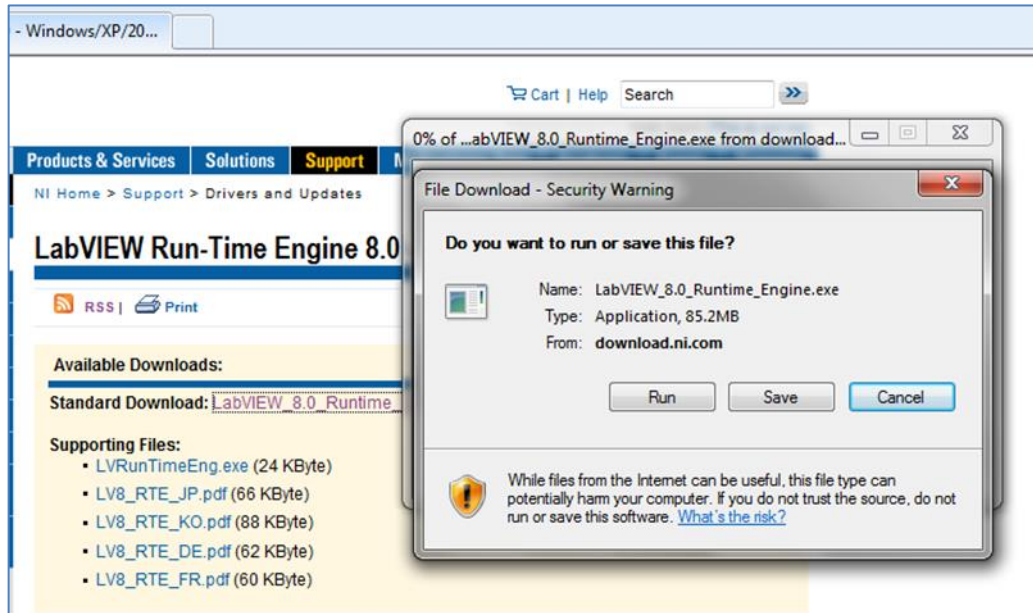


The screenshot shows the National Instruments website interface. The main content area is titled "LabVIEW Run-Time Engine 8.0 - Windows/XP/2000". Under the "Available Download:" section, the "Standard Download: LabVIEW_8.0_Runtime_Engine.exe (85 MB)" link is circled in blue. A blue arrow points from the text "Click to Download Program" to this link. Below this, under "Supporting Files:", there is a list of files including "LVRuntimeEng.exe (24 KByte)", "LV8_RTE_JP.pdf (66 KByte)", "LV8_RTE_KO.pdf (88 KByte)", "LV8_RTE_DE.pdf (62 KByte)", and "LV8_RTE_FR.pdf (60 KByte)". A blue arrow points from the text "Click to Download Supporting Documents In Other Languages" to this list. The page also includes a "Request Support from an engineer" button and technical specifications for the software.

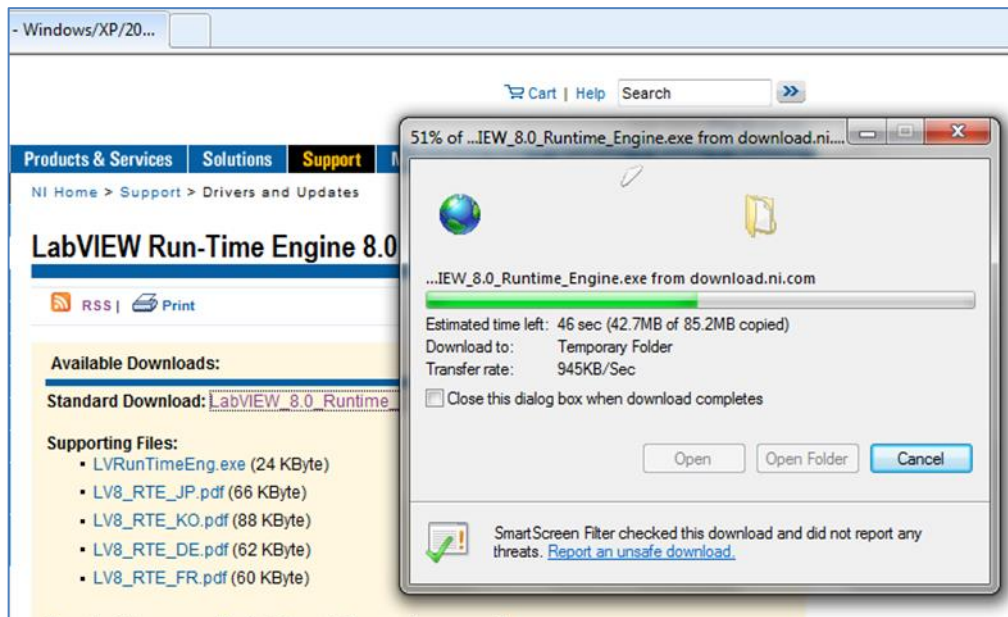
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NOTE: return to the above screen afterwards if you would like to install supporting files in any of five languages.

The screen will appear as follows. Click on “Run”.

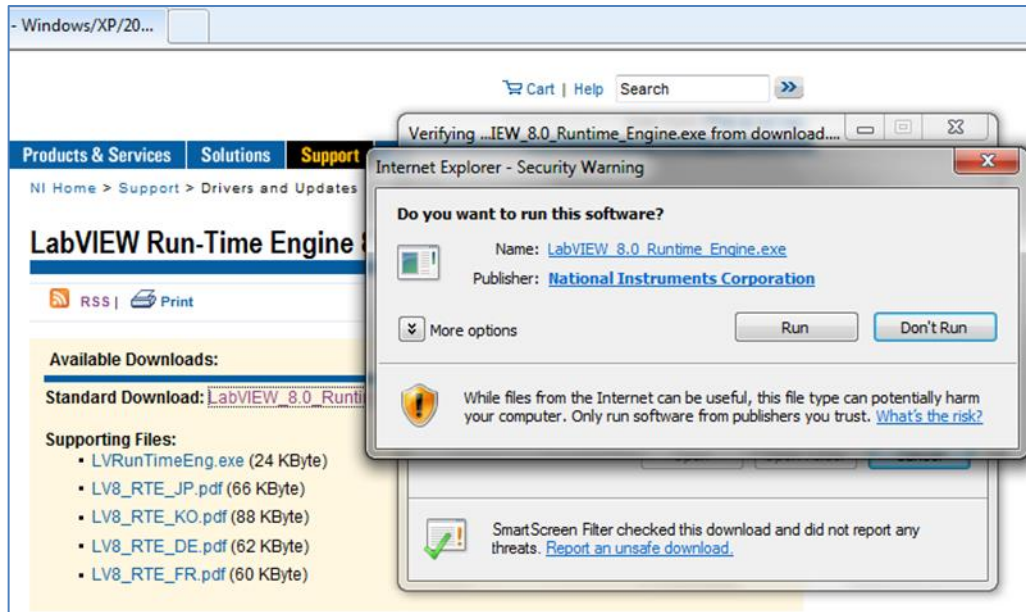


The screen will appear as follows. Wait for the download process to finish.

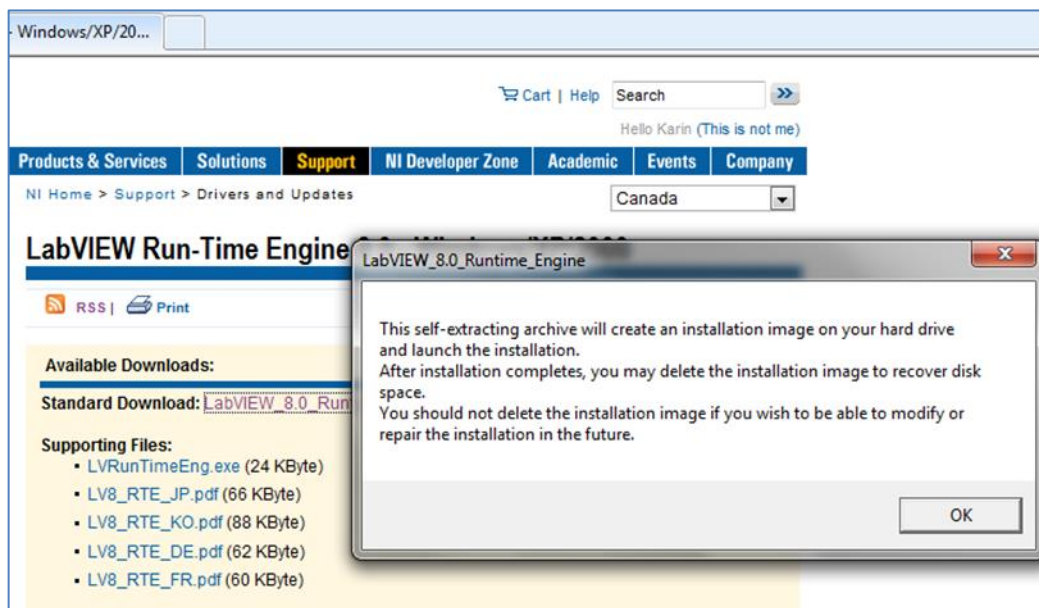


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The screen will appear as follows. Click on “Run”.

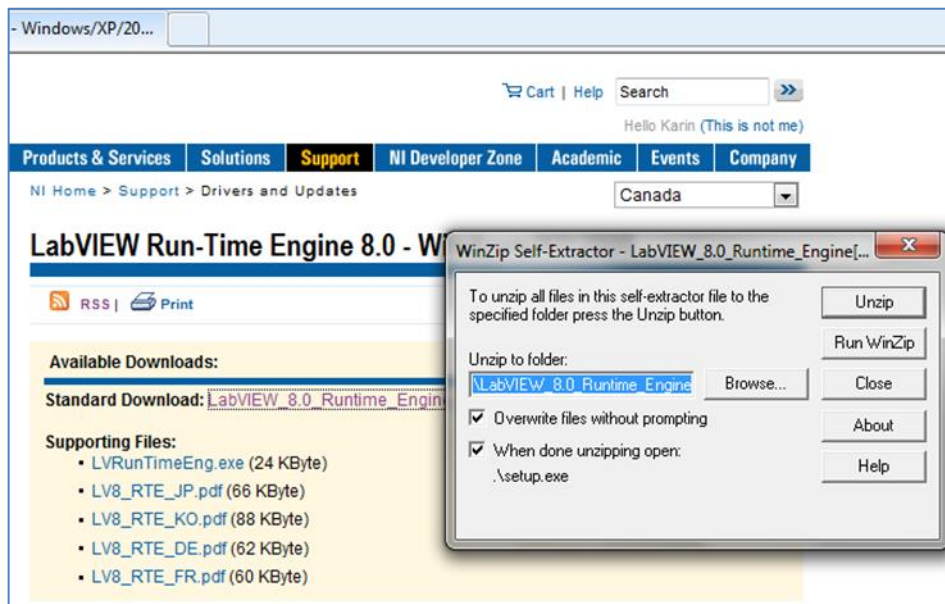


After the program downloads, the screen will appear as follows. Click on “OK” to continue.

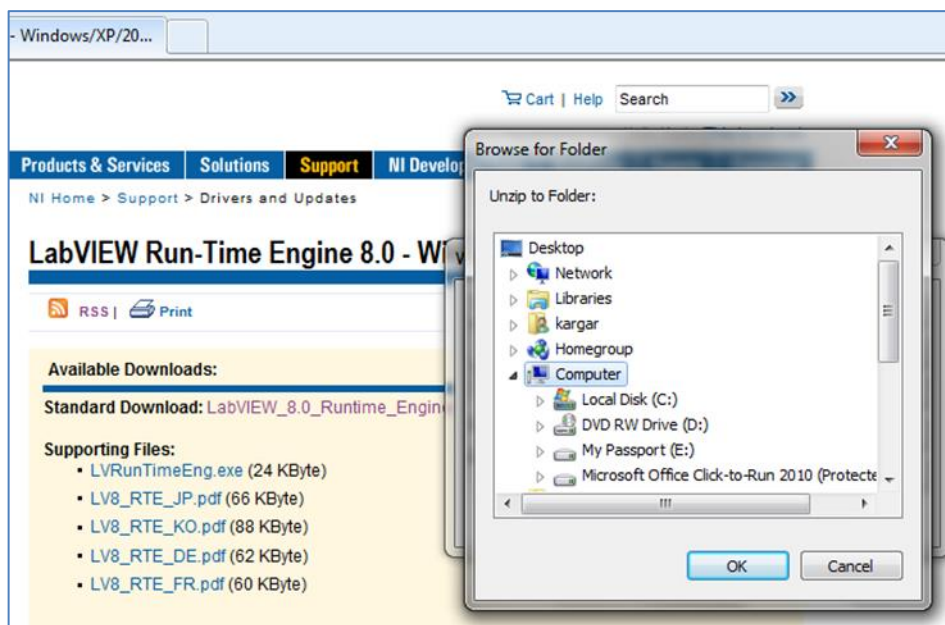


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The screen will appear as follows. If you want to select the directory to use for installing LabVIEW, click on “Browse”.

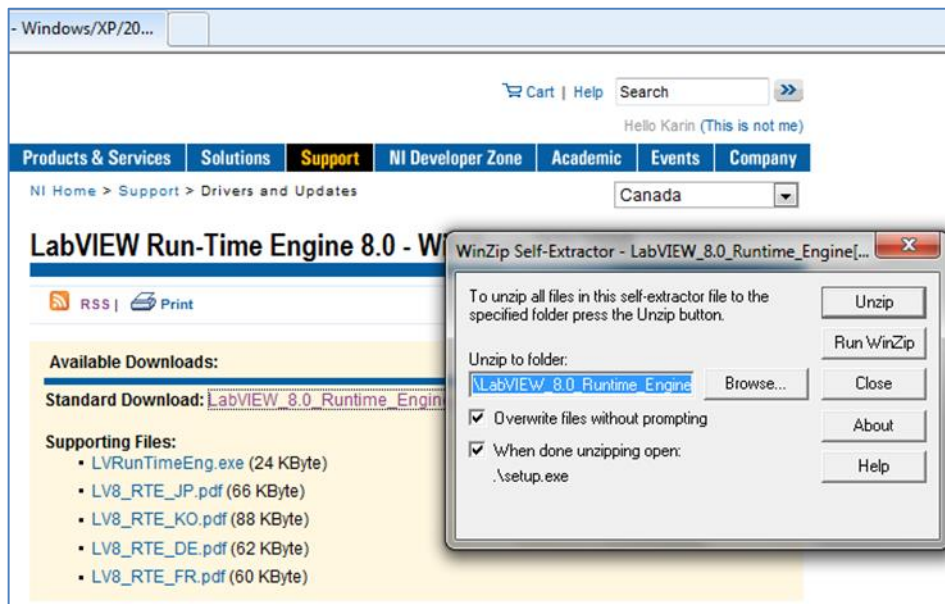


A “browse for folder” window will pop up as follows, allowing you to select the directory. Click on “OK” when you are done.



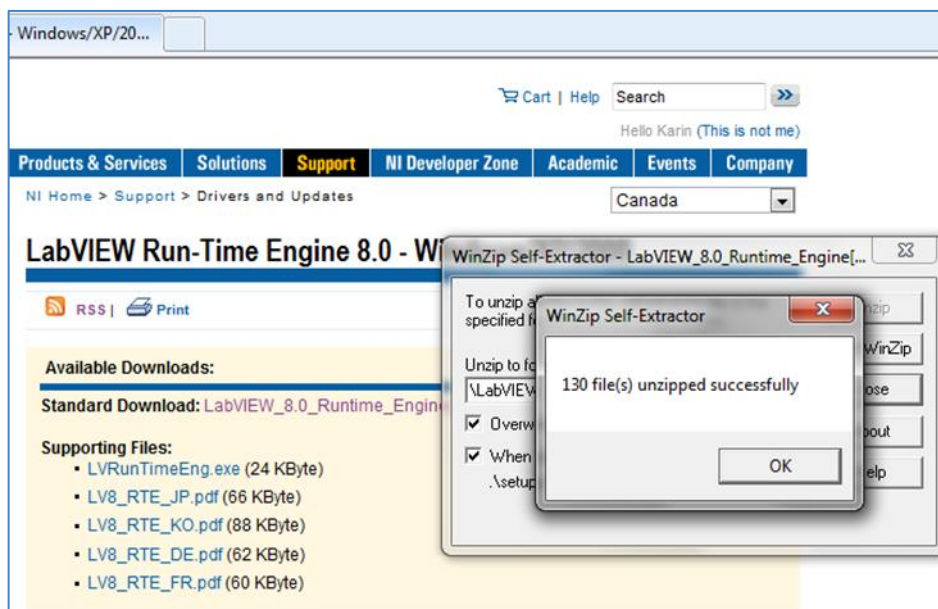
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The screen will appear as follows. Click on “Unzip” to unzip the LabVIEW program files to the directory you selected, or to the default directory.



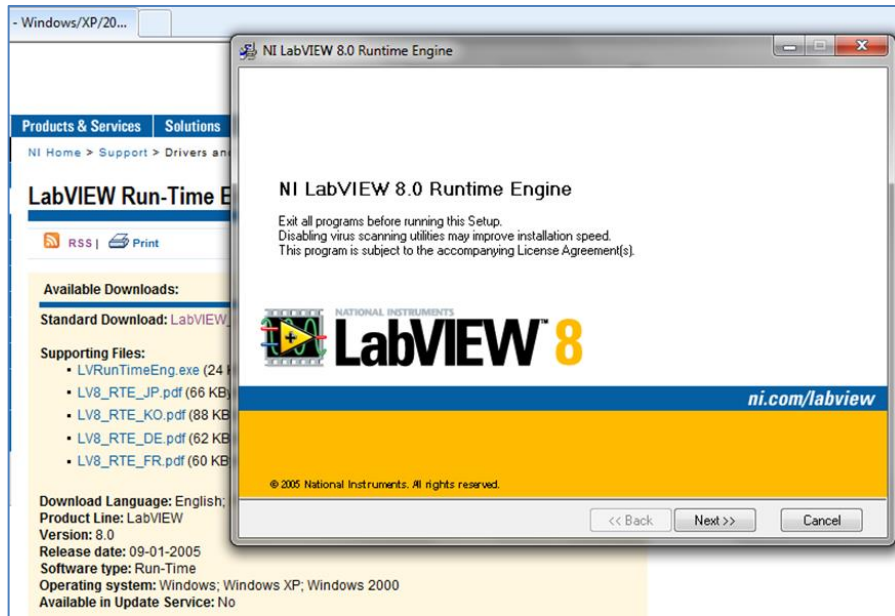
The screen will appear as follows. Click on “OK” in the pop-up window.

Another screen may pop up, asking if you wish to allow LabVIEW to make changes to your computer – if this screen - pops up, click on “OK” to continue.

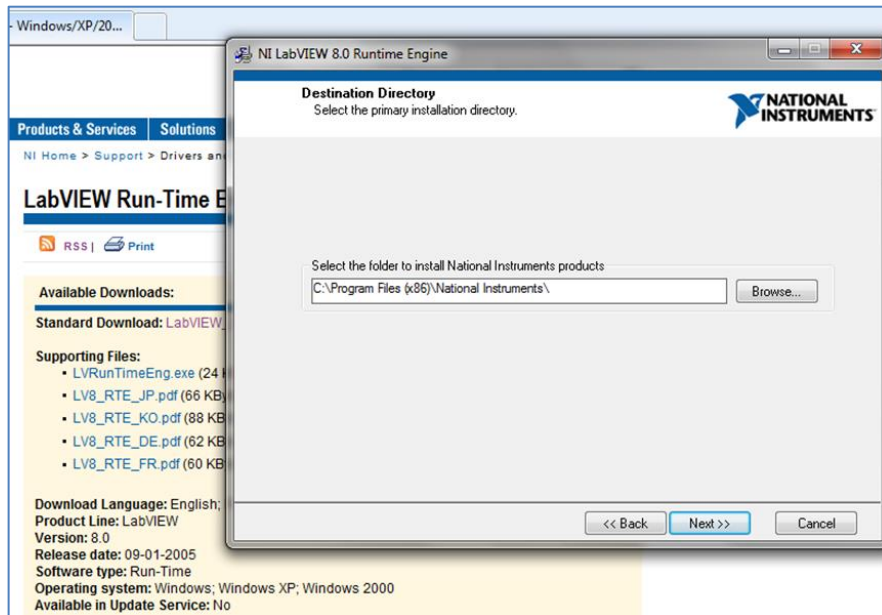


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The screen will appear as follows. Click on “Next” to proceed with the installation.

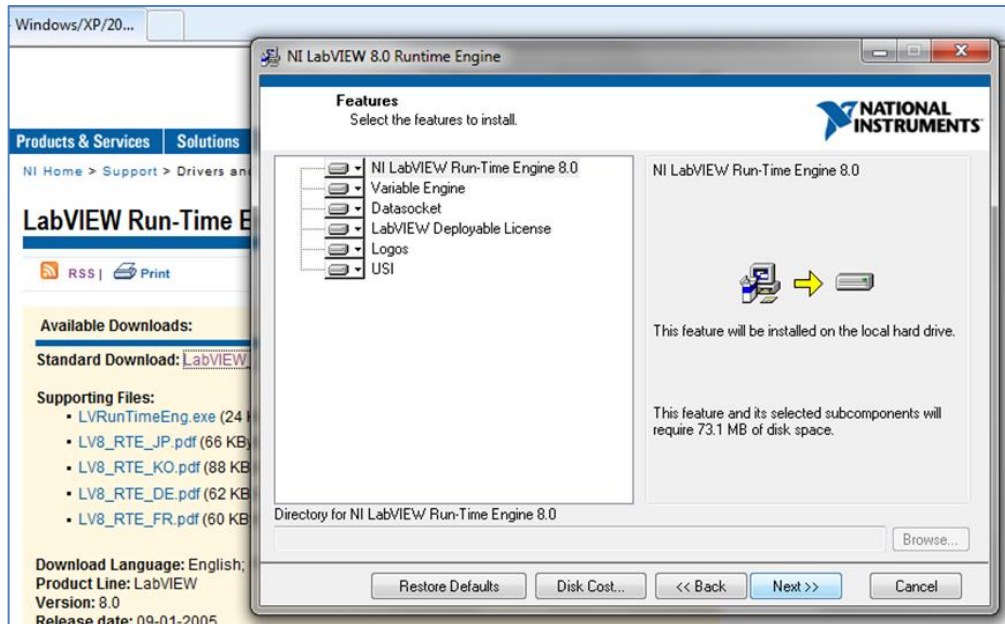


The screen will appear as follows. If you want to select the directory to install LabVIEW to, click on “Browse” – a “browse” window will pop up, allowing you to select the directory. Click on “OK” when you are done, then click on “Next”.

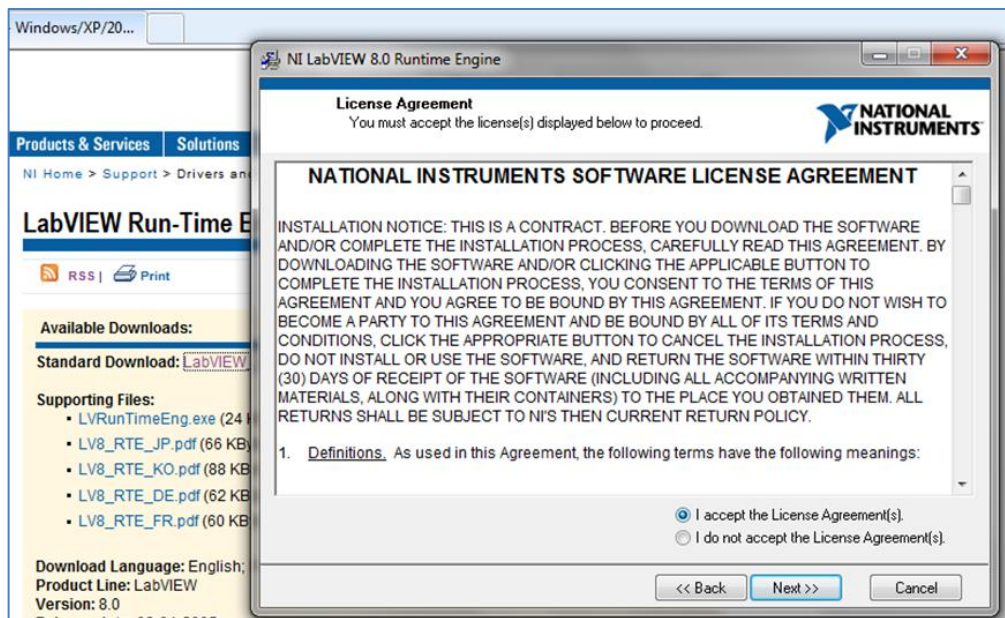


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The screen will appear as follows. Click on “Next” to continue.

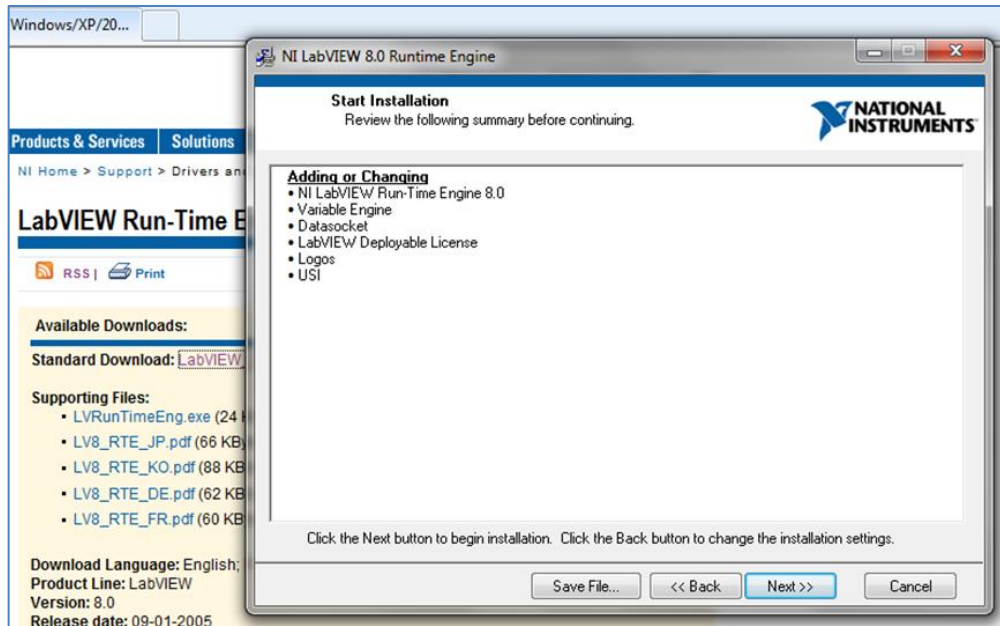


The screen will appear as follows. Select “I accept the Licence Agreement(s)”, then click on “Next” to continue.

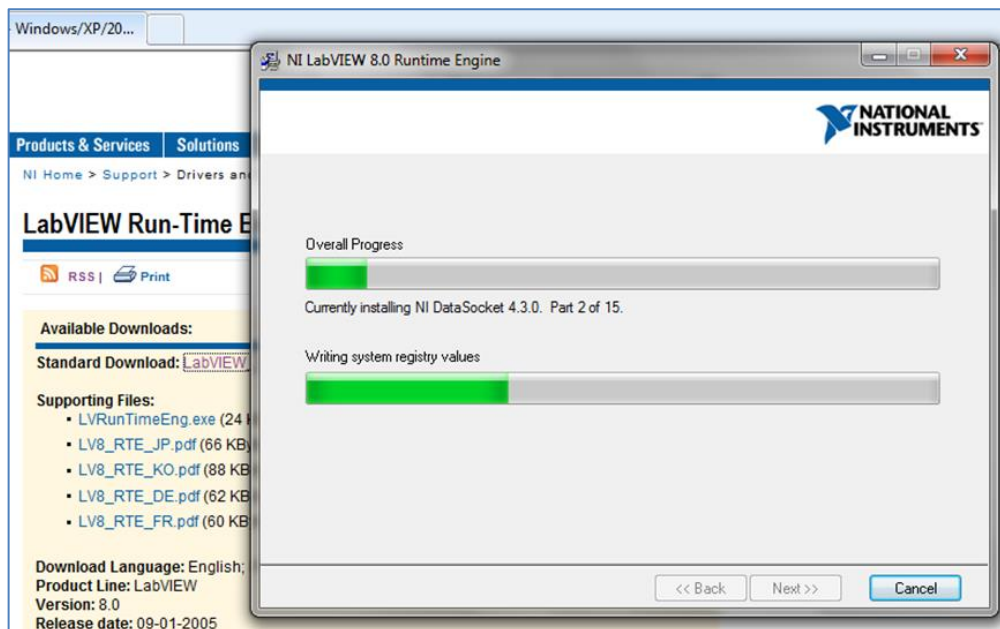


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The screen will appear as follows. Click on “Next” to continue.

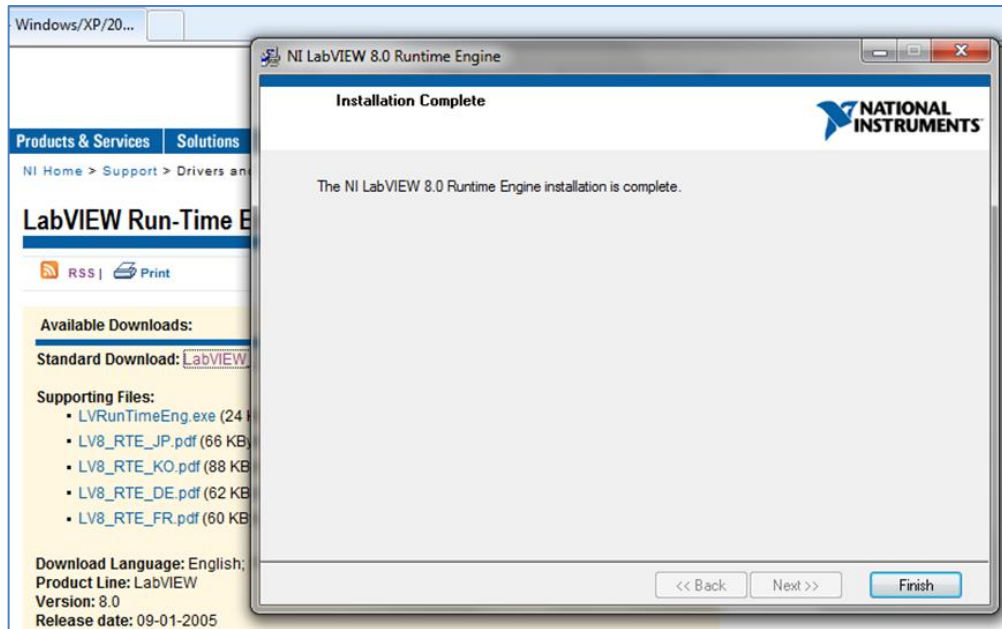


The screen will appear as follows. Wait while the program installs.

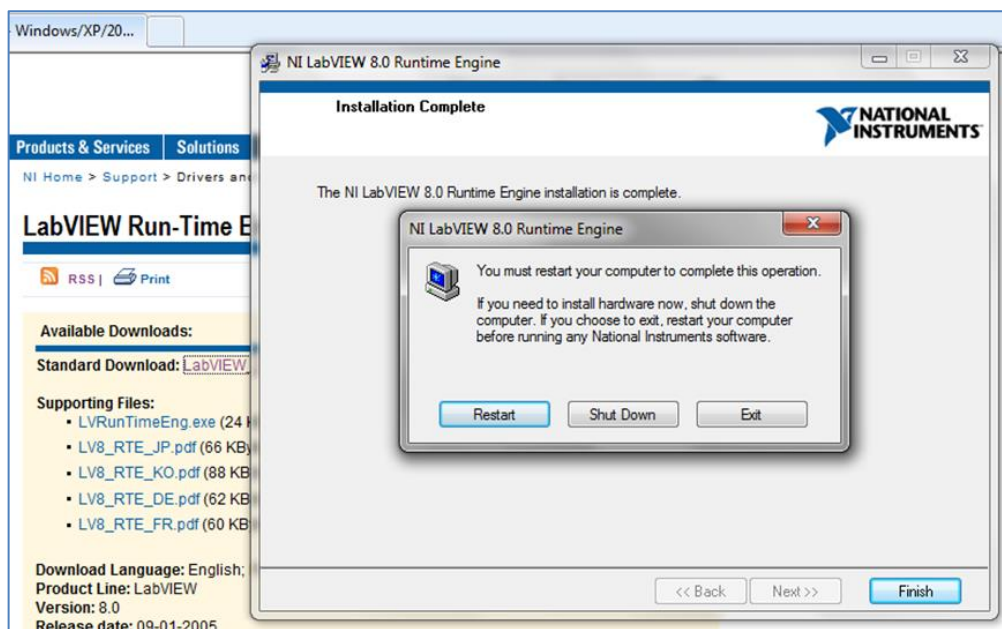



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The screen will appear as follows. Click on “Finish”.



The screen will appear as follows.




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If you want to restart the computer immediately, click on “Restart”.

If you want to shut down the computer immediately, click on “Shut Down”.

If you want to restart the computer manually, click on “Exit” to exit the installation process and return to Windows. You must still restart the computer before the installation will take effect.

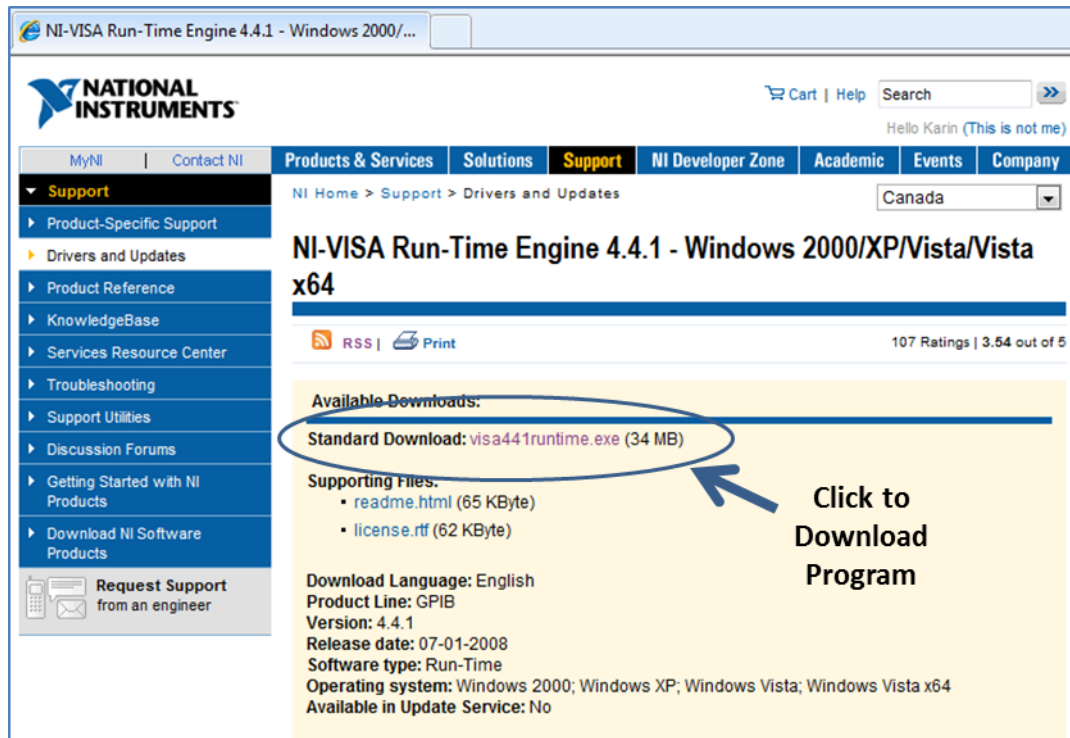
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INSTALLING THE LABVIEW NI VISA RUNTIME ENGINE

If you already have LabVIEW Runtime Engine and LabVIEW NI-VISA Runtime Engine installed, go to “Installing the HHT Test Pattern (LabVIEW)” on page 66.

To install the LabVIEW NI-VISA Runtime Engine, do the following:

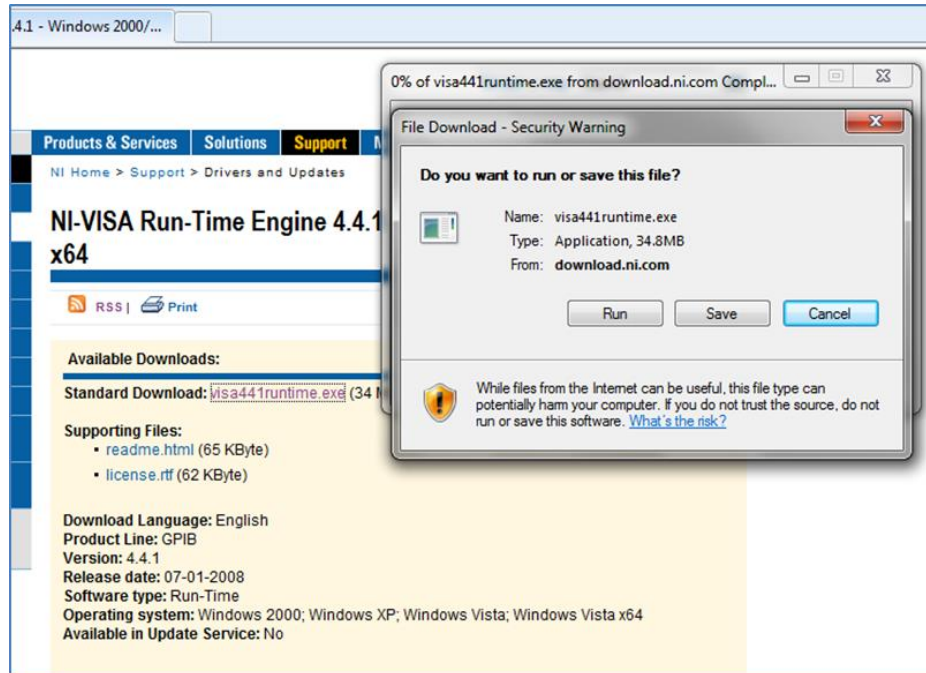
Action	
STEP 1	Start up the computer.
STEP 2	Go to any browser program and click on or type in the following link: http://joule.ni.com/nidu/cds/view/p/id/1071/lang/en Click on the “visaXYZruntime.exe” link (see below) (version number may be different than shown)



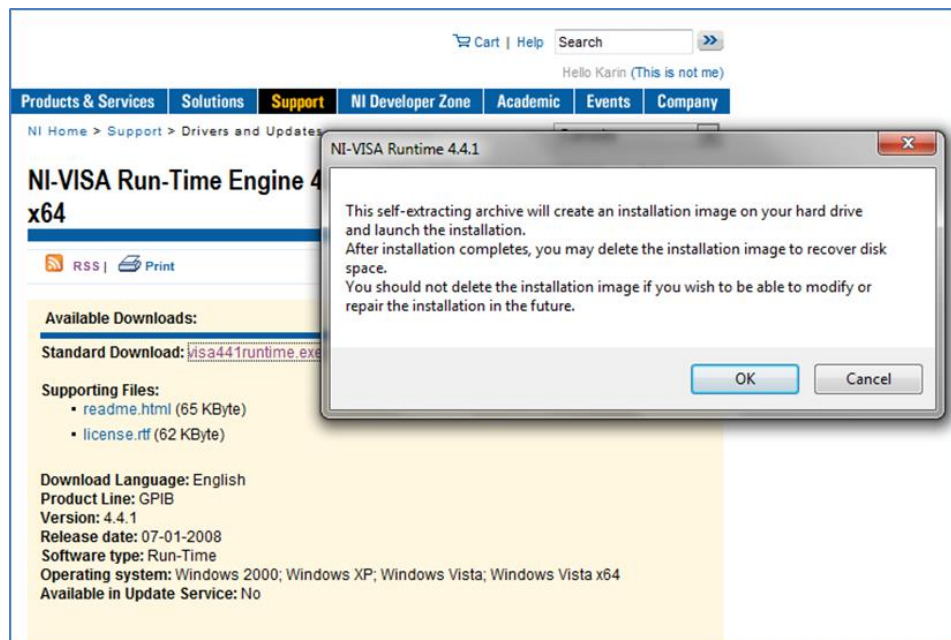
The screenshot shows the National Instruments website page for the NI-VISA Run-Time Engine 4.4.1. The page title is "NI-VISA Run-Time Engine 4.4.1 - Windows 2000/XP/Vista/Vista x64". Under the "Available Downloads" section, the link "Standard Download: visa441runtime.exe (34 MB)" is circled in blue. A blue arrow points from the text "Click to Download Program" to this link. Other sections include "Supporting Files" (readme.html, license.rtf), "Download Language: English", "Product Line: GPIB", "Version: 4.4.1", "Release date: 07-01-2008", "Software type: Run-Time", "Operating system: Windows 2000; Windows XP; Windows Vista; Windows Vista x64", and "Available in Update Service: No".

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The screen will appear as follows. Click on “Run”.

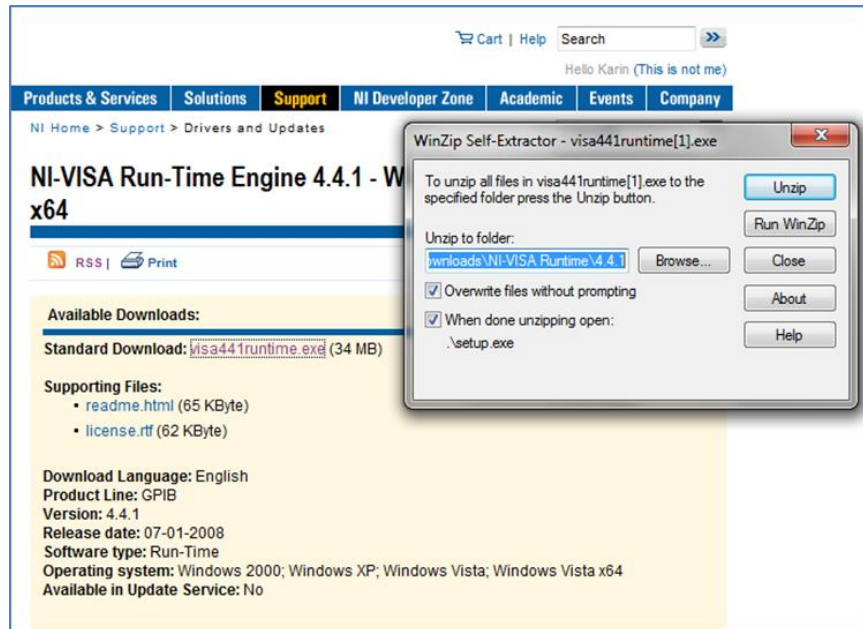


After the program downloads, the screen will appear as follows. Click on “OK” to continue.



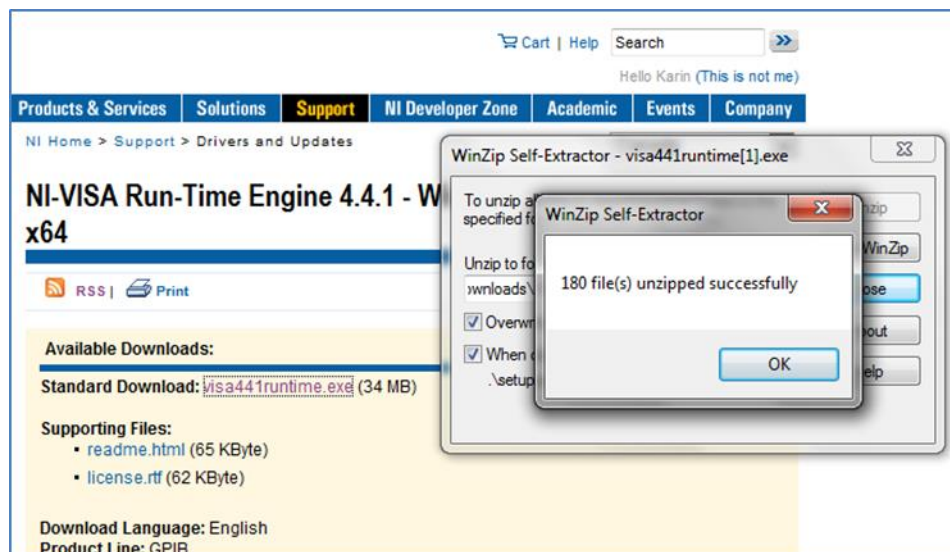
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The screen will appear as follows. If you want to select the directory to use for installing LabVIEW, click on “Browse”.



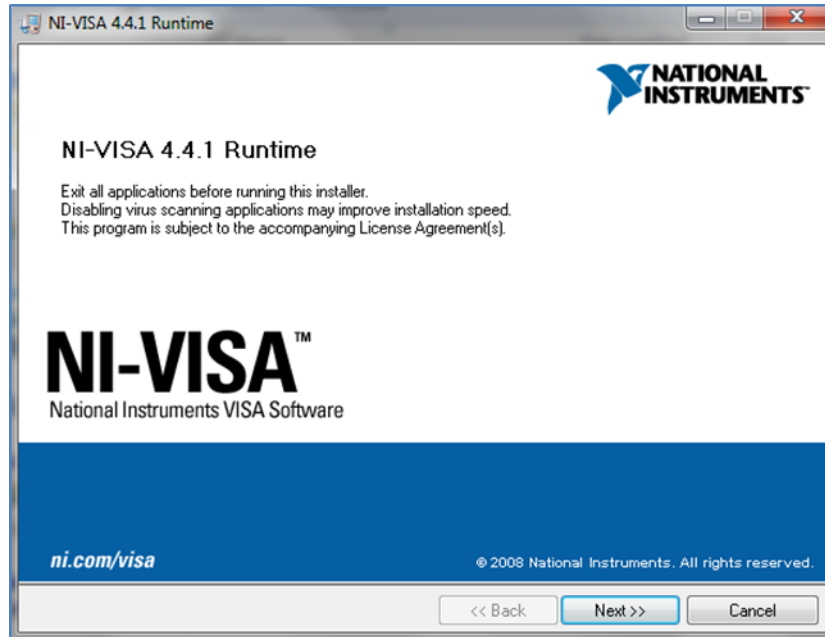
The screen will appear as follows. Click on “OK” in the pop-up window.

Another screen may pop up, asking if you wish to allow LabVIEW to make changes to your computer – if this screen pops up, click on “OK” to continue.

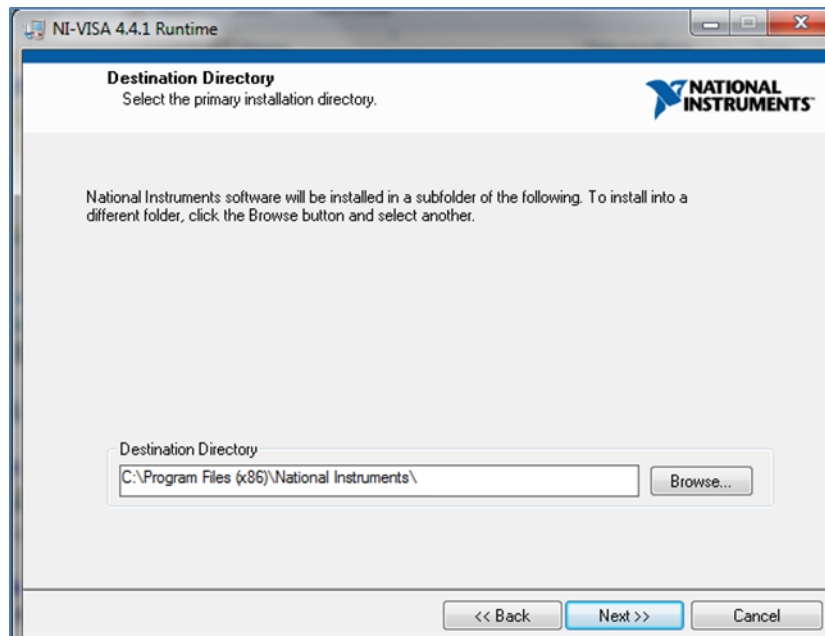


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The screen will appear as follows. Click on “Next” to proceed with the installation.

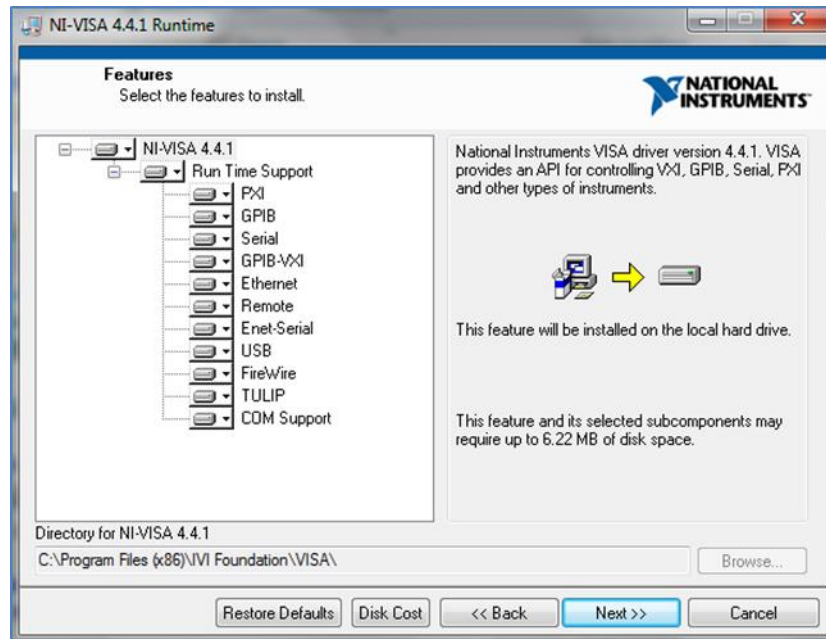


The screen will appear as follows. If you want to select the directory to install LabVIEW NI-VISA to, click on “Browse” – a “browse” window will pop up, allowing you to select the directory. Click on “OK” when you are done, then click on “Next”.

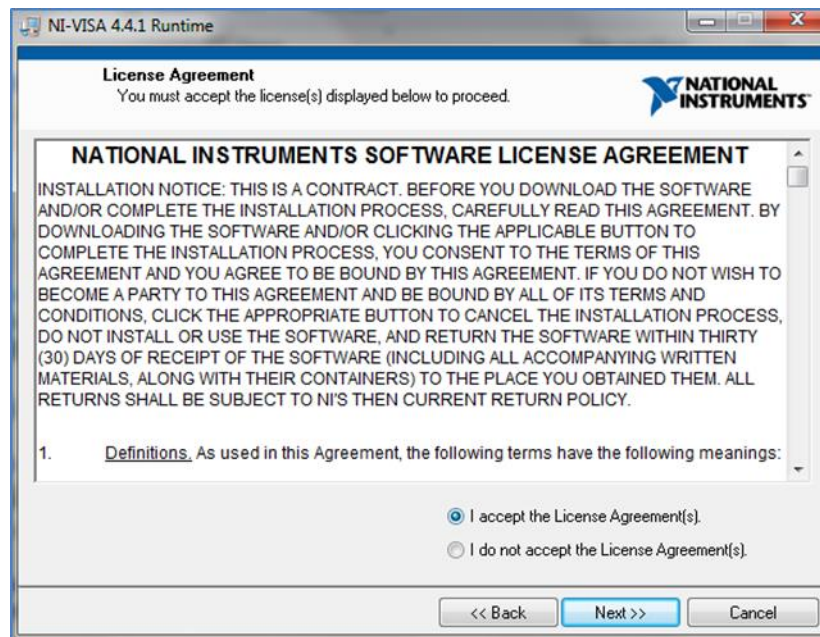


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The screen will appear as follows. Click on “Next” to continue.

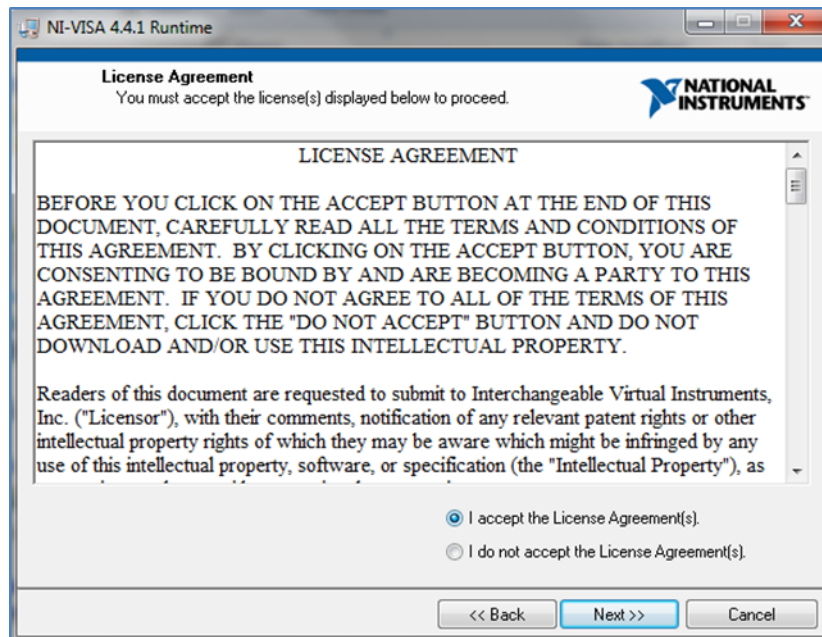


The screen will appear as follows. Select “I accept the Licence Agreement(s)”, then click on “Next” to continue.

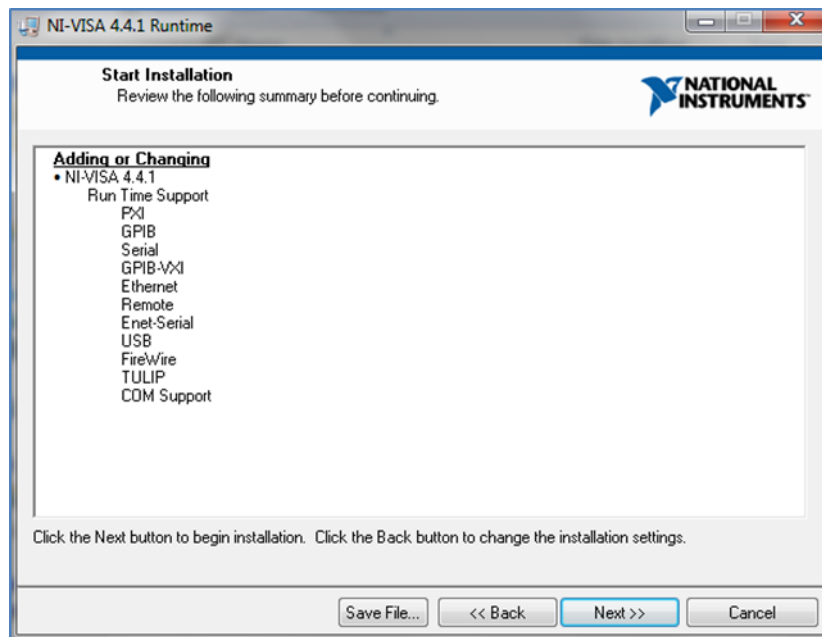



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The screen will appear as follows. Select “I accept the Licence Agreement(s)”, then click on “Next” to continue.

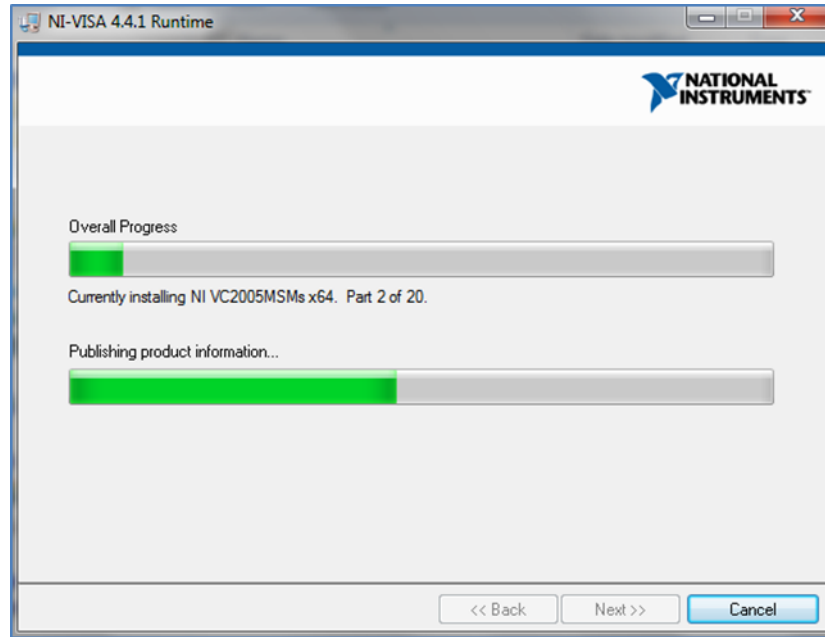


The screen will appear as follows. Click on “Next” to continue.

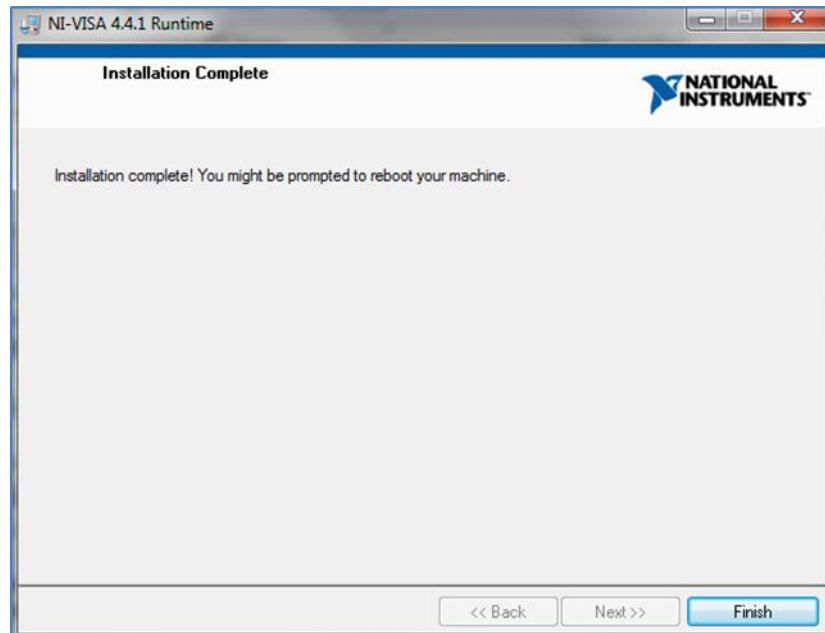


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The screen will appear as follows. Wait while the program installs.

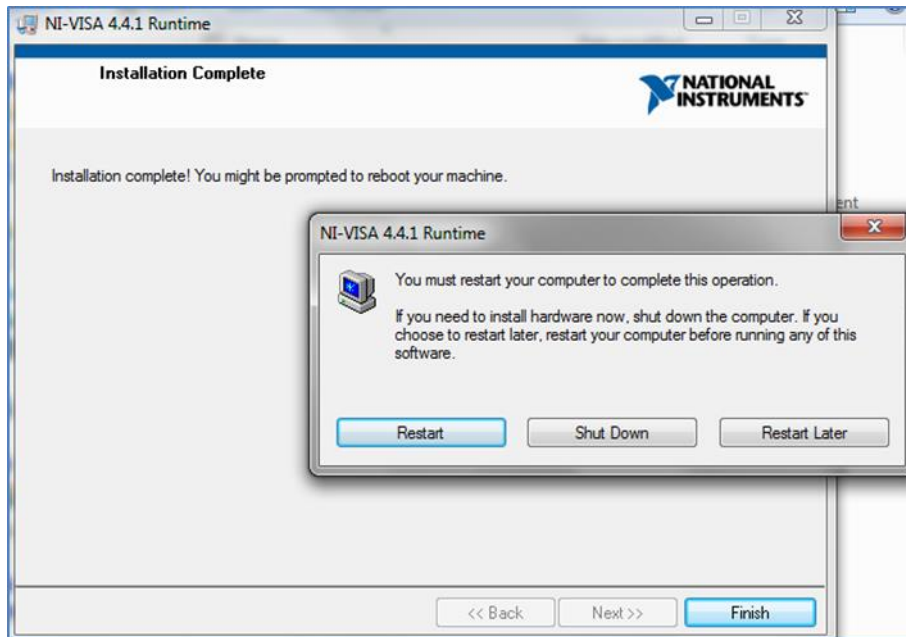


The screen will appear as follows. Click on “Finish”.



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The screen will appear as follows.



If you want to restart the computer immediately, click on “Restart”.

If you want to shut down the computer immediately, click on “Shut Down”.

If you want to restart the computer manually, click on “Exit” to exit the installation process and return to Windows. You must still restart the computer before the installation will take effect.

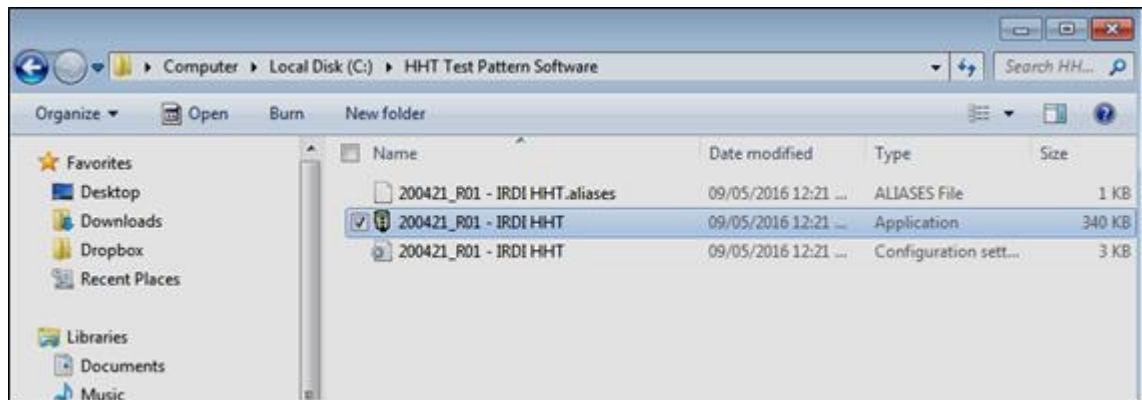
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INSTALLING THE HHT TEST PATTERN (LABVIEW) SOFTWARE


The following instructions are based on using Windows 7 – the screen appearance may differ slightly for other Windows versions.

To install the HHT test pattern (LabVIEW) software, do the following:

Action	
STEP 1	Start up the computer.
STEP 2	Insert the USB memory stick provided.
STEP 3	Copy the three program files and the “read.me” file (see below) to a new folder on the computer. All three files are needed to run the HHT test pattern software.



Action	
STEP 4	To run the HHT test pattern software, double-click on the “ 200421_R01 IRDI HHT ” application.
NOTE	Recommended: Right-click on the “ 200421_R01 IRDI HHT ” application and select “Create Shortcut”. Copy the shortcut to the desktop.

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Appendix B: UPDATING THE HHT FIRMWARE

Occasionally, a firmware upgrade will be provided for the HHT. This upgrade will consist of a firmware (HEX) file.

To program the HHT firmware, do the following:

Action	
STEP 1	Make sure that the HHT has batteries, or that it has a 3.6 VDC power supply attached.
STEP 2	Start up the computer, and make sure it is connected to the internet.
STEP 3	<p>Connect the HHT USB to a computer USB port, and wait while the FTDI drivers install automatically.</p> <p>If the drivers do not install automatically, manually install the drivers following the instructions at this link: http://www.ftdichip.com/Drivers/VCP.htm</p> <p>NOTE: You may need to restart your computer afterwards if the com port does not show up in your list of ports (under Windows Control Panel).</p>
STEP 4	Install the “Serial Bootloader AN1310 v1.05r” program.
STEP 5	Open the Serial Bootloader program – see Figure 6-3.
STEP 6	<p>Go to “Program -> Settings”.</p> <p>Choose the correct com port for the HHT and click on “OK” – see Figures Figure 6-1 and Figure 6-2.</p> <p>Make sure that the COM port is connected – see Figure 6-3.</p>

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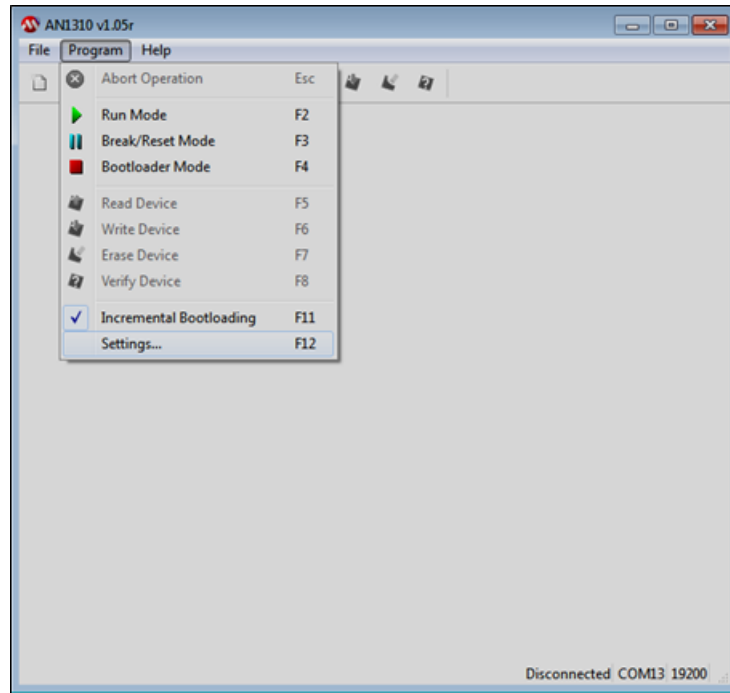


FIGURE 6-1 SERIAL BOOTLOADER PROGRAM – SELECTING “SETTINGS”

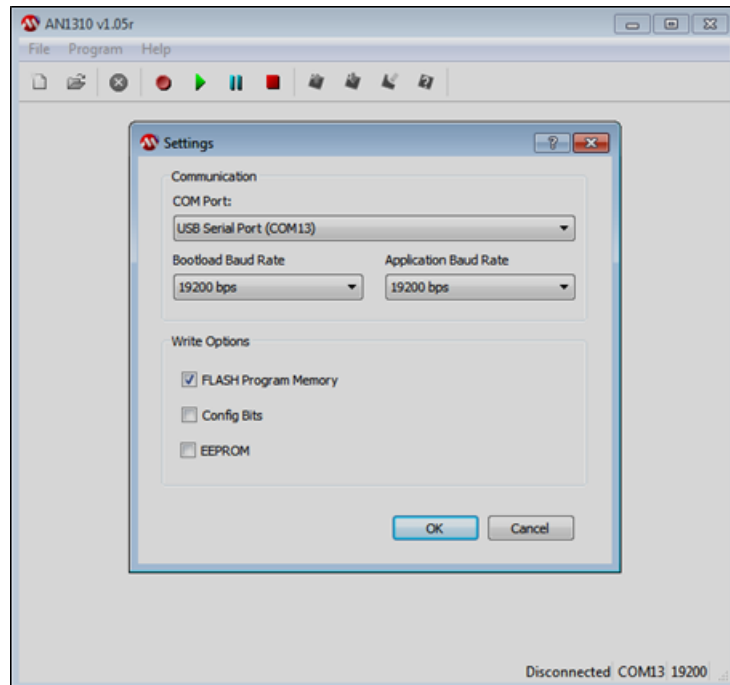


FIGURE 6-2 SERIAL BOOTLOADER PROGRAM – SELECTING COM PORT

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Action	
STEP 7	Click on the red square button to enter bootloader mode – see Figure 6-3. Make sure that the bottom toolbar indicates that the HHT is connected.
STEP 8	In the “File” menu, click on “Open”, and open the HEX file provided by IRDI.
STEP 9	Click on the “Write Device” button, to program the firmware – see Make sure that the bottom toolbar indicates that the programming was successful – see Figure 6-5.
STEP 10	Click on the green arrow to run the firmware and exit bootloader mode. NOTE: Alternatively, you can power cycle the HHT to run the firmware, or unplug the USB connector from the HHT, then plug it back it, which forces a reset of the HHT via the RTS line.
STEP 11	Make sure that the power light and the “Test 1” light on the front of the HHT are both on.

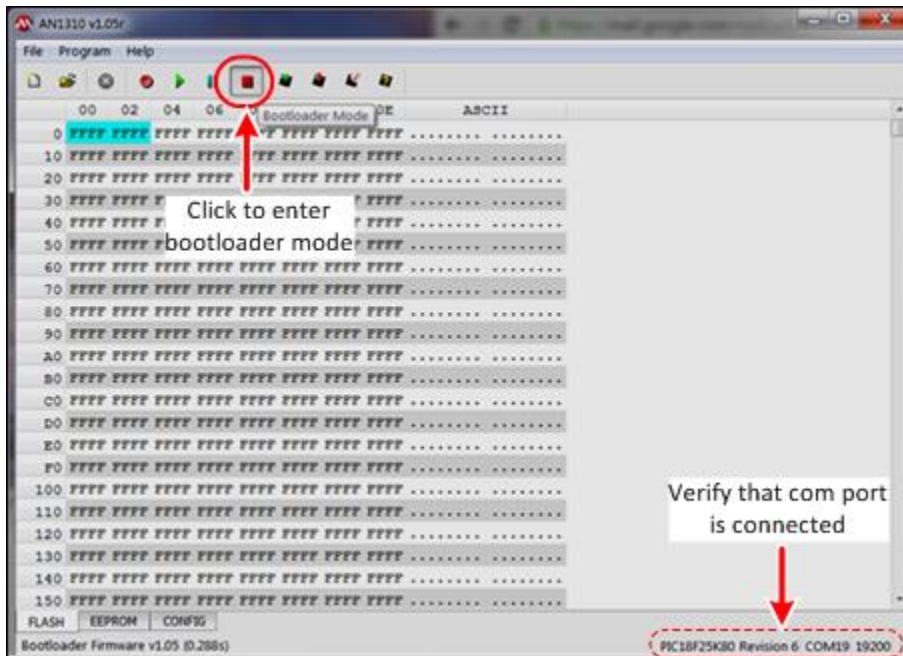


FIGURE 6-3 SERIAL BOOTLOADER PROGRAM – CONNECTING TO HHT

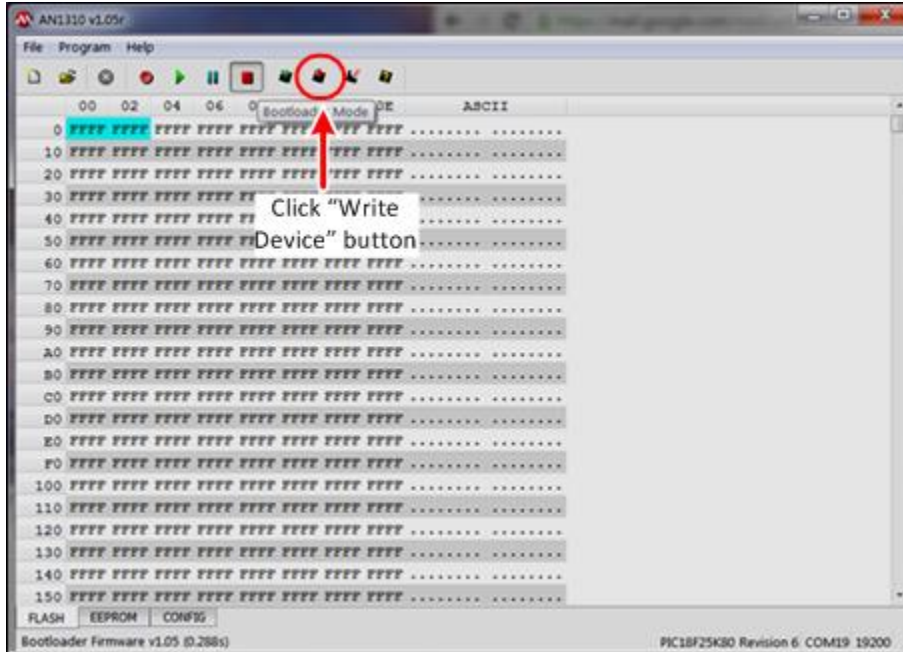


FIGURE 6-4 SERIAL BOOTLOADER PROGRAM – CLICK ON “WRITE DEVICE”

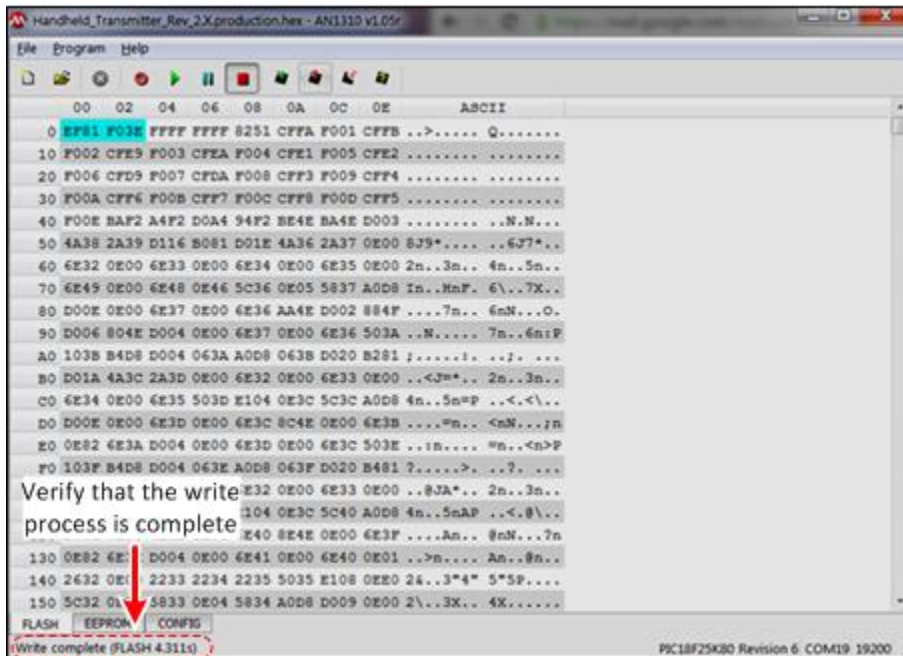


FIGURE 6-5 SERIAL BOOTLOADER PROGRAM – PROGRAMMING FIRMWARE