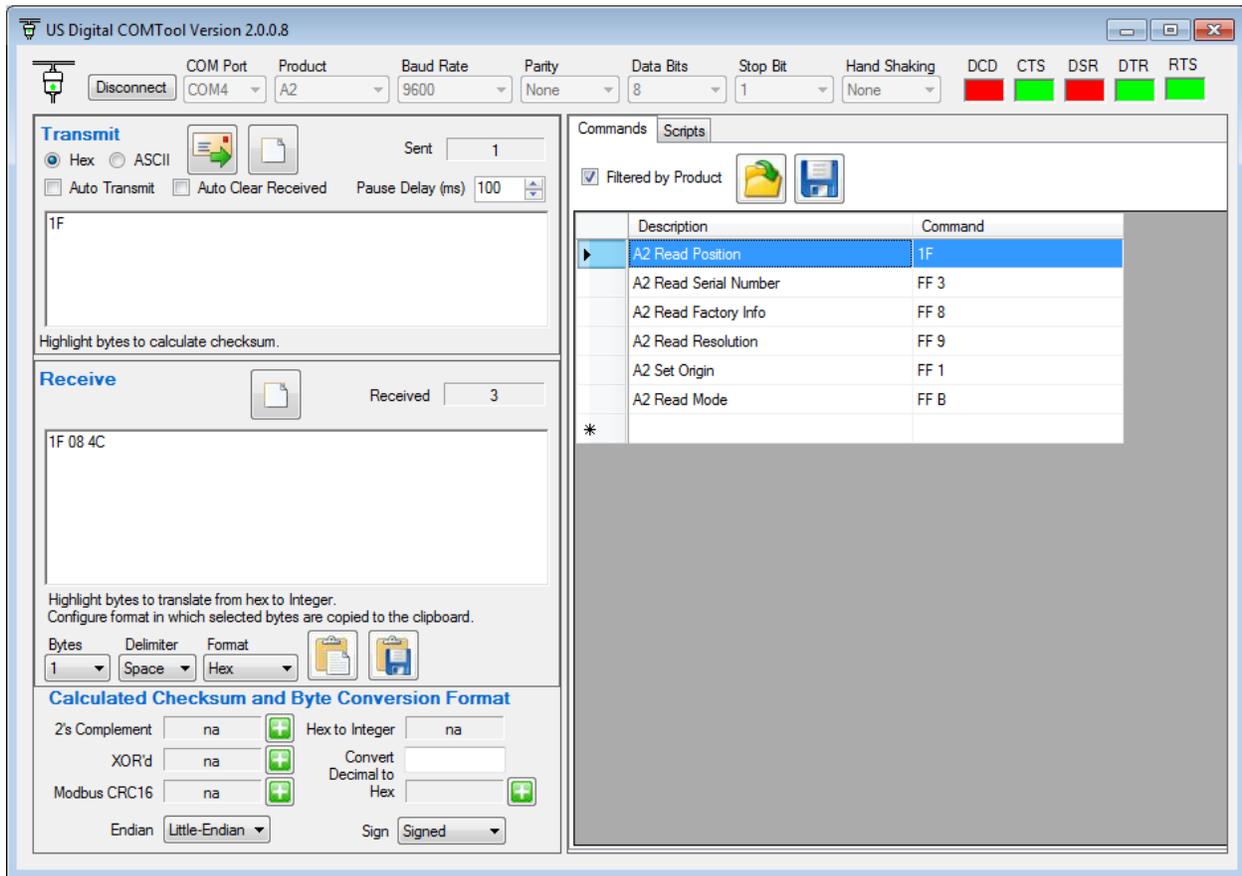


COMTool User Guide

Version 1.1

12/02/2013



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COMTool User Guide

Version 1.1
12/02/2013

Contents

Terms and Conditions of License for use of gratuitous software	3
Purpose:	3
Installation Instructions:.....	4
Using COMTool:.....	8
Select a COM Port.....	8
Select a product.....	8
Selecting data as Hex or ASCII	10
Calculating 2's compliment, XOR'd, or Modbus CRC16 value	10
Big-Endian vs. Little-Endian	11
Entering a Command.....	11
Transmitting Data	11
Clear Transmit or Receive Text Boxes.....	12
Copy Selected Received bytes to Clipboard	12
Commands Tab	15
Scripts Tab.....	16
Adding a New Script Command	17
Editing a Script Command.....	18
Deleting a Script Command.....	18
Reorder Command Sequence.....	18
Selecting Commands to Execute	18
Executing a Scripts Command	19



COMTool User Guide

Version 1.1
12/02/2013

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Purpose:

The US Digital COMTool application is designed to assist debugging of serial communication between host PC and US Digital devices that provide a serial interface. This document describes how to install the COMTool application and use all available features.



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Version 1.1
12/02/2013

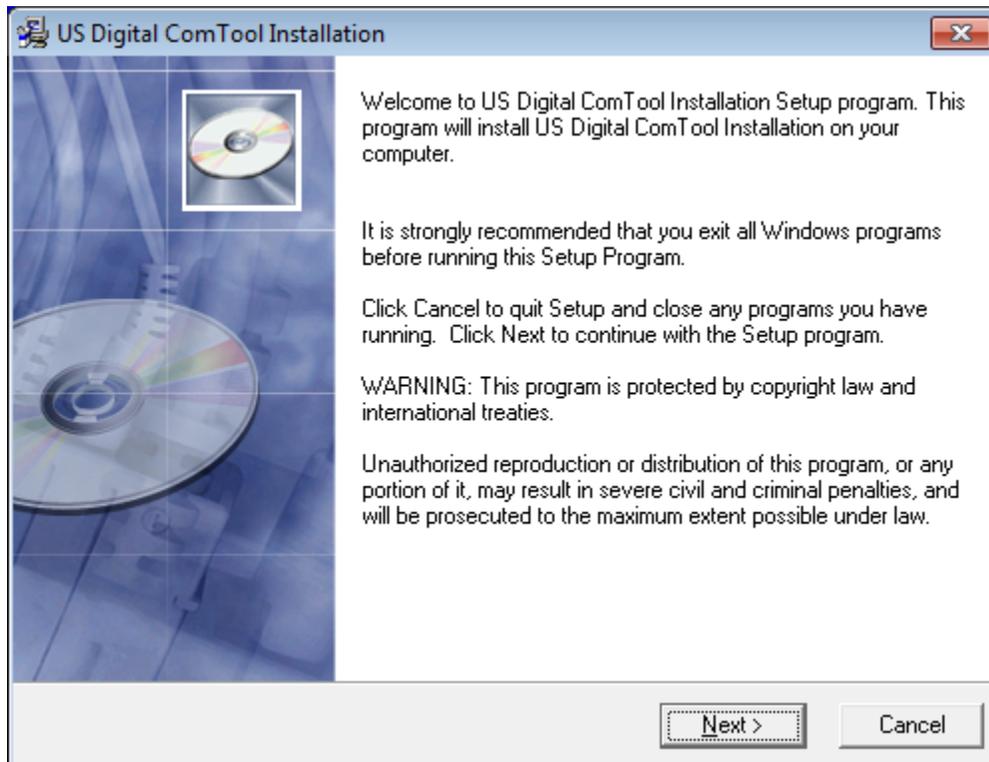
Installation Instructions:

Download the COMTool application from US Digital website
<http://usdigital.com/support/software/comtool> and run the COMTool Installation.

The installation program will install the COMTool application with a preloaded list of commonly used commands for US Digital serial devices. Drivers for a specific US Digital device can be downloaded from US Digital's device specific software page.

The following is a list of some of the US Digital serial devices supported by the COMTool application: A2, QSB, T7 (mod2 and mod4), and X3.

The COMTool setup program displays the following sequence of screen shots. Typically the Next button is clicked on each screen to install the default COMTool configuration.



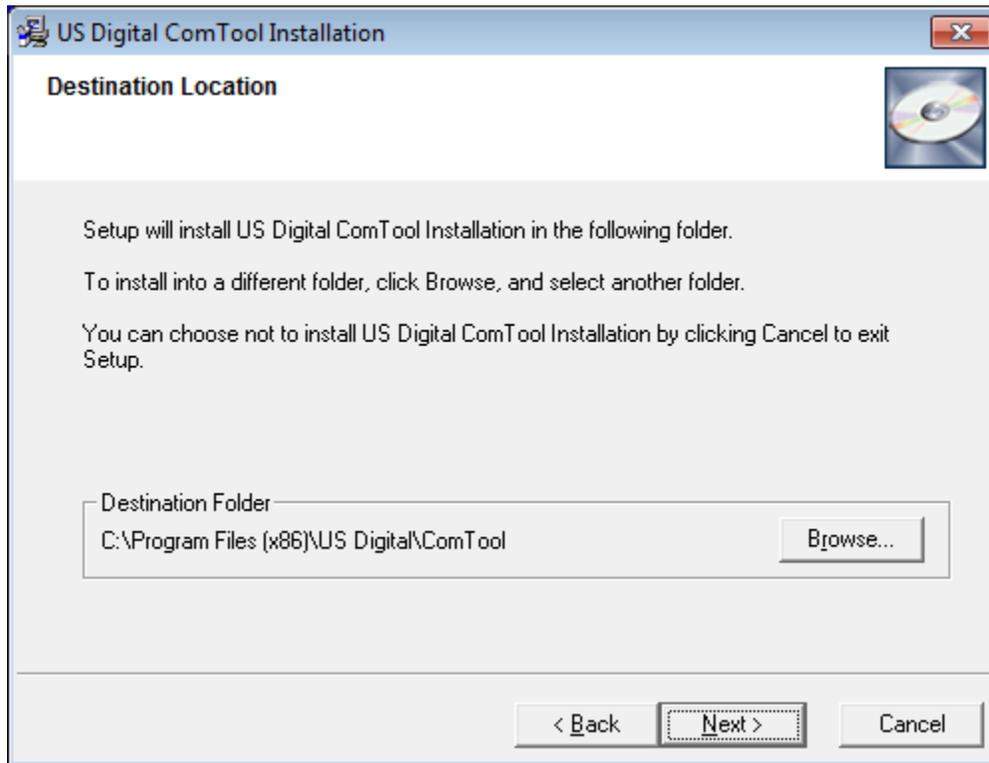
Click the Next button.



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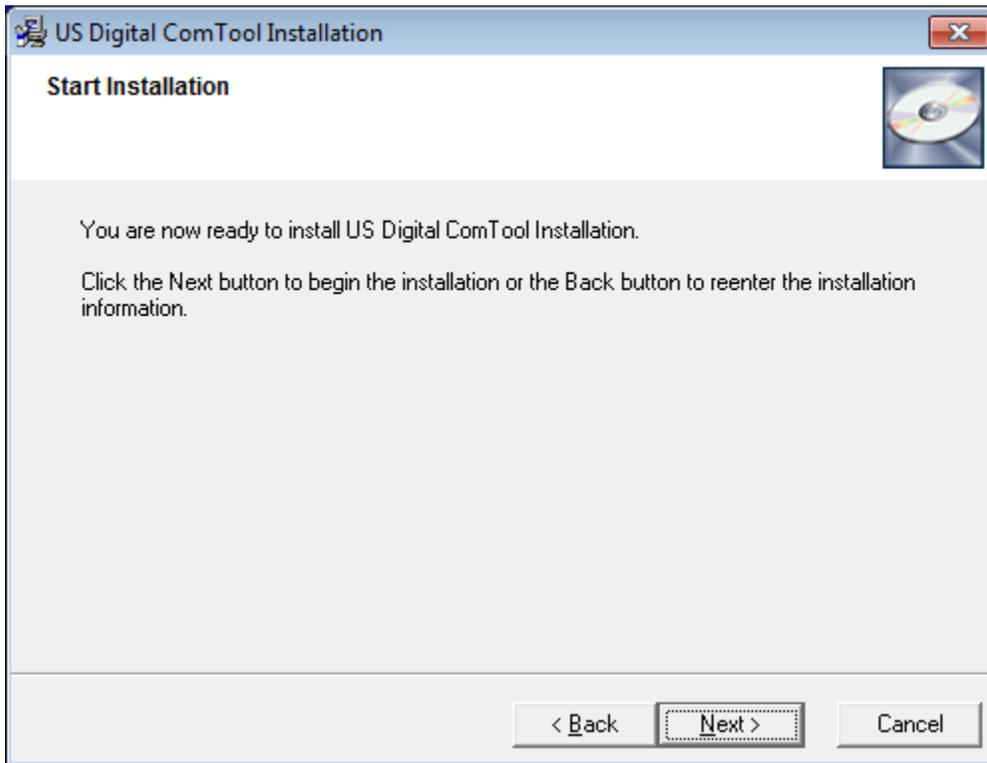
Version 1.1
12/02/2013



Click the Next button unless the default program destination folder needs to be changed.

COMTool User Guide

Version 1.1
12/02/2013



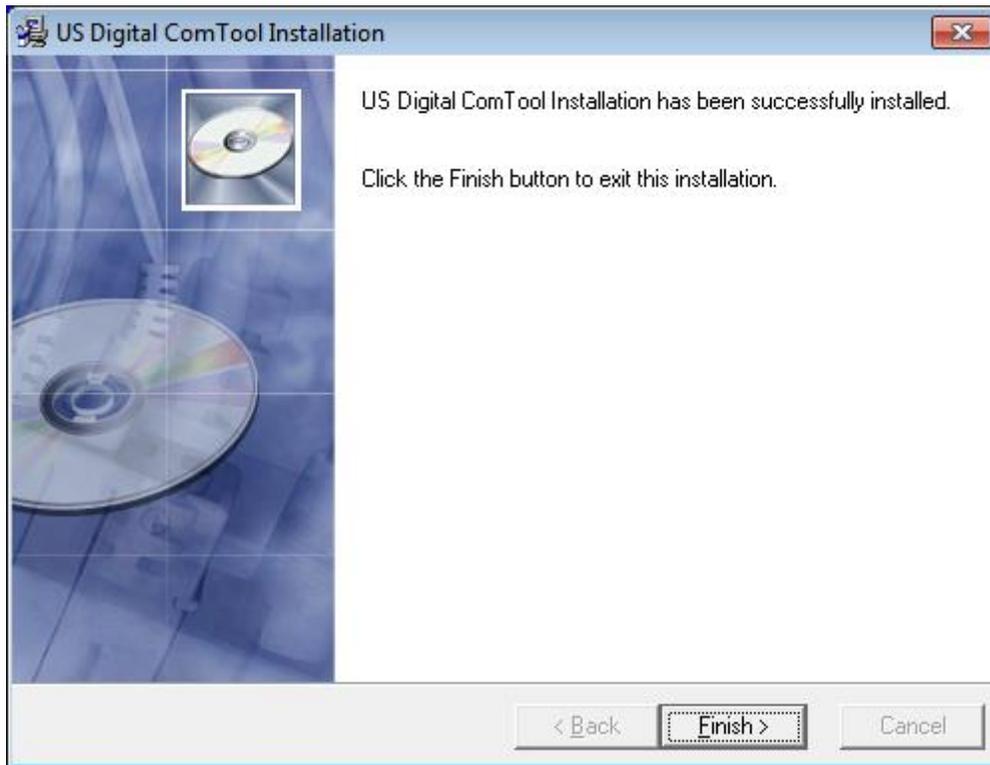
Click the Next button.



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Version 1.1
12/02/2013



Click the Finish button.

COMTool User Guide

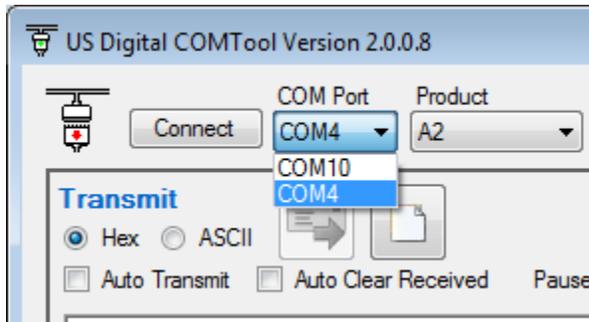
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12/02/2013

Using COMTool:

Locate and start the COMTool program.

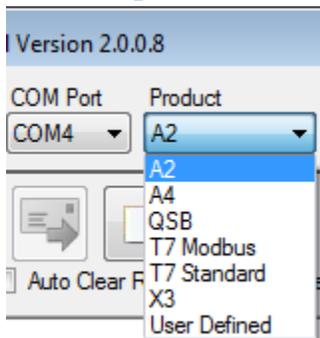
Click on the Windows Start Icon. Click on the All Programs menu item. Locate and click the US Digital\COMTool menu item from the Windows Start menu.

Select a COM Port



Select the COM port that the target device uses. If there is more than one COM port listed, then the target device COM port can be identified by observing the COM Port list while the device is unplugged and then re-plugged. The device will disappear when unplugged and then re-appear once plugged back in.

Select a product



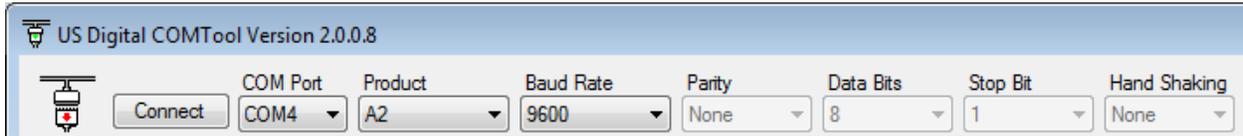
Selecting a predefined product causes the COM port settings to automatically be selected for Baud Rate, Parity, Data Bits, Stop Bit, and Hand Shaking. These COM port settings will be disabled except for baud rate on most US Digital devices. If non-standard COM settings are required, then select User Defined Product.



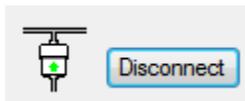
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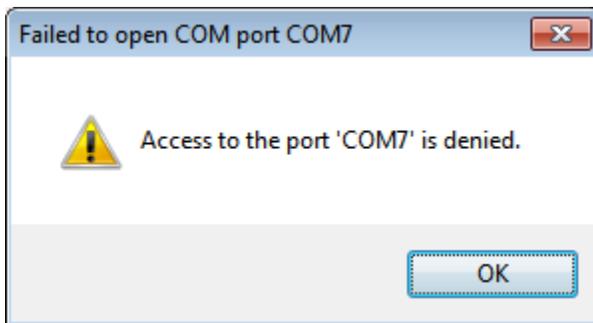
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12/02/2013



After the appropriate COM port settings have been set, click on the Connect button. If the selected COM port is successfully opened, then connection icon will show connected with a green arrow.



If the COM port is already opened by another application, then the following message will be displayed. Only one application can have the COM port open at a time.



COMTool User Guide

Version 1.1
12/02/2013

The screenshot displays the COMTool interface with three main sections:

- Transmit:** Includes radio buttons for Hex (selected) and ASCII, checkboxes for Auto Transmit and Auto Clear Received, a Pause Delay (ms) spinner set to 100, and a text field containing the hex string "05 07 84 02 00 00 29 04 41". Below the field is the instruction "Highlight bytes to calculate checksum."
- Receive:** Includes a Received counter set to 0, a text field, and instructions: "Highlight bytes to translate from hex to Integer. Configure format in which selected bytes are copied to the clipboard." Below this are dropdowns for Bytes (4), Delimiter (CR-LF), and Format (Integer), along with clipboard icons.
- Calculated Checksum and Byte Conversion Format:** A table of calculated values and conversion options:

2's Complement	41		Hex to Integer	na
XOR'd	A9		Convert	
Modbus CRC16	8F 23		Decimal to	
			Hex	
Endian	Big-Endian		Sign	Signed

Selecting data as Hex or ASCII

Select either Hex or ASCII format. The COMTool provides the ability to send and receive data as either Hex or ASCII characters. Selecting a predefined product automatically selects the appropriate data format. Most of the US Digital products use Hex formatted commands.

Calculating 2's compliment, XOR'd, or Modbus CRC16 value

To ensure data integrity, some devices require that commands include a checksum especially when performing a write command or changing a device's configuration. By selecting the bytes to be transmitted, the COMTool automatically calculates three different types of checksum values: 2's compliment, XOR'd, or Modbus CRC16.

To append the checksum value to the end of the command, click on the add button next to the desired value. The checksum fields and the Hex to Integer field will display "na" when no data is highlighted in the Transmit or Receive field, otherwise the appropriate checksum and Hex to Integer value will be calculated. The Hex to Integer field will only have a valid value if four or less bytes are selected.



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Version 1.1
12/02/2013

Calculated Checksum and Byte Conversion Format				
2's Complement	na	+	Hex to Integer	na
XOR'd	na	+	Convert	1025
Modbus CRC16	na	+	Decimal to Hex	00 00 04 01
Endian	Big-Endian			
			Sign	Signed

To determine the hexadecimal value for a decimal number, enter the decimal number into the Convert Decimal to Hex field. The Hex value will automatically update as the decimal value is entered. To append the converted decimal to hex value to the end of the command, click on the add  button.

Big-Endian vs. Little-Endian

For most devices, the Endian value is set to Big-Endian where the first byte is most significant and the last byte is least significant.

Example: Decimal 123456 in Big-Ending is hex value 00 01 E2 40 and in Little-Ending is 40 E2 01 00.

Entering a Command

The data can be entered manually or by selecting a command from the Commands list view. Double-clicking the command in the Commands list view will automatically copy the command to the transmit text box and send the command to the device. If sending hex commands, separate each hex byte with a space.

Every character or byte sent is accumulated and displayed in the Sent count label. Every character or byte received is accumulated and displayed in the Received count label.

Transmitting Data

Click on the  send button to transmit the value in the transmit text box to the device. Double-clicking a command in the Commands list view will place the command in the Transmit text box and automatically send the command to the device. The response from the device will appear in the Receive area text box. Each command response will be appended to the end of the previously received data.



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Version 1.1
12/02/2013

To continuously transmit the same command to the device, check the Auto Transmit checkbox and then click the send button. Click the Auto Clear Received check box to clear the Received textbox prior to sending the next command. To translate a specific hex value returned from the device to an integer value, highlight the hex value to translate. The Hex to Integer field will automatically be updated to reflect the integer value. If reporting the absolute position of an A2 encoder, highlight the returned hex position value and the Hex to Integer field will show the translated value. With the hex position values still highlighted, check the Auto Transmit checkbox and then click send. The highlighted position values will remain highlighted and the Hex to Integer value will automatically be updated on the return of a read position command. This feature makes it easier to decipher the reported position value as the encoder position value changes.

Clear Transmit or Receive Text Boxes

To clear the Transmit or Receive area text boxes, click the clear  button within the respective area.

Copy Selected Received bytes to Clipboard

There are a couple options when it comes to copying the bytes received from the device to the clipboard. The default format used to copy the received data to the Windows clipboard is one byte at a time separated by a space and left in the hex format.

Bytes	Delimiter	Format
4	CR-LF	Integer

- Specify the number of bytes to be grouped together. The possible options available in the Bytes drop down list are 1, 2, and 4.
- Specify the delimiter to be used to separate the evaluated groupings. The possible options available in the Delimiter dropdown list are Space, Comma, Tab, and CR-LF.
- Specify the output format. The possible Format values are Hex and Integer. Highlight the data received that is to be copied to the clipboard.

COMTool User Guide

Version 1.1
12/02/2013



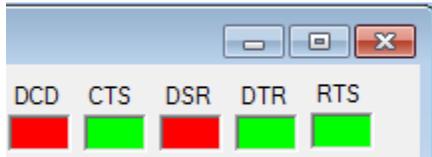
Highlight the data received using the mouse cursor and click the copy to clipboard button. If the received data looks like the following, then the table below shows examples for the clipboard content format.

00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F

Bytes	Delimiter	Format	Clipboard Contents
1	Space	Hex	00 01 02 03 04 05 06 07 08 09 0A 0B 0C 0D 0E 0F
2	Space	Hex	0001 0203 0405 0607 0809 0A0B 0C0D 0E0F
4	Space	Hex	00010203 04050607 08090A0B 0C0D0E0F
2	Comma	Hex	0001,0203,0405,0607,0809,0A0B,0C0D,0E0F
2	Comma	Integer	1,515,1029,1543,2057,2571,3085,3599
4	Comma	Integer	66051,67438087,134810123,202182159
4	CR-LF	Integer	66051 67438087 134810123 202182159

COMTool User Guide

Version 1.1
12/02/2013



COM I/O Status Indicators

RS-232 device may be classified as Data Terminal Equipment (DTE) or Data communication Equipment (DCE). The COM I/O Status indicators represent the status of some of the primary communication lines and will be greyed out when the COM port is closed otherwise they are red or green.

The DCD indicator stands for Data Carrier Detect and is green when holding and red when not holding.

The CTS indicator stands for Clear to Send and is green when the data communication equipment is ready to accept data and the line is high and the indicator red when it is low and not ready to receive data.

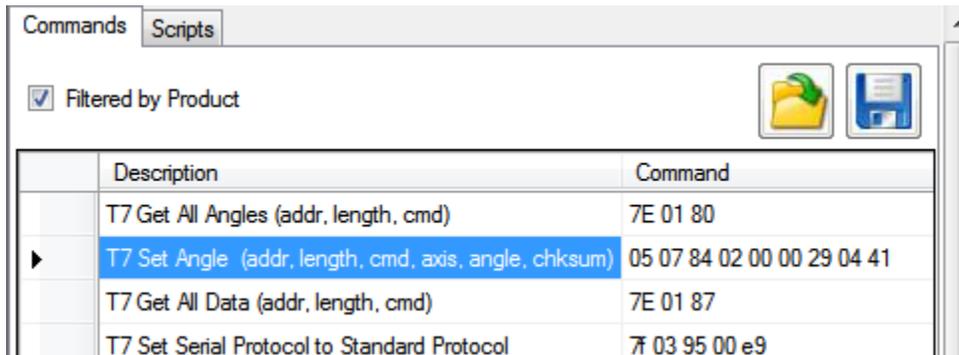
The DSR indicator stands for Data Set Ready and is green when the data communication equipment is ready to receive commands or data and is red when not ready.

The DTR indicator stands for Data Terminal Ready and is green when the presence of DTE to DCE is detected and red when it is not connected.

The RTS indicator stand for Request to Send and is green when the DTE request the DCE to prepare to receive data and red when no request is present.

COMTool User Guide

Version 1.1
12/02/2013



Commands Tab

The Commands tab on the right half of the COMTool application is used to list a predefined set of device commands that are stored in an MS Access database or .mdb file. Each command contains a Description and Command field. The Description field typically identifies the device and what the command does. The Command field contains the ASCII text or hex bytes that can be sent to a device. When the COMTool application is first launched, the user may be prompted for the location of the COMTool.mdb file. The typical path is C:\Program Files(x86)\US Digital\COMTool\COMTool.mdb for 64 bits Windows and C:\Program Files\US Digital\COMTool\COMTool.mdb for 32 bit systems.

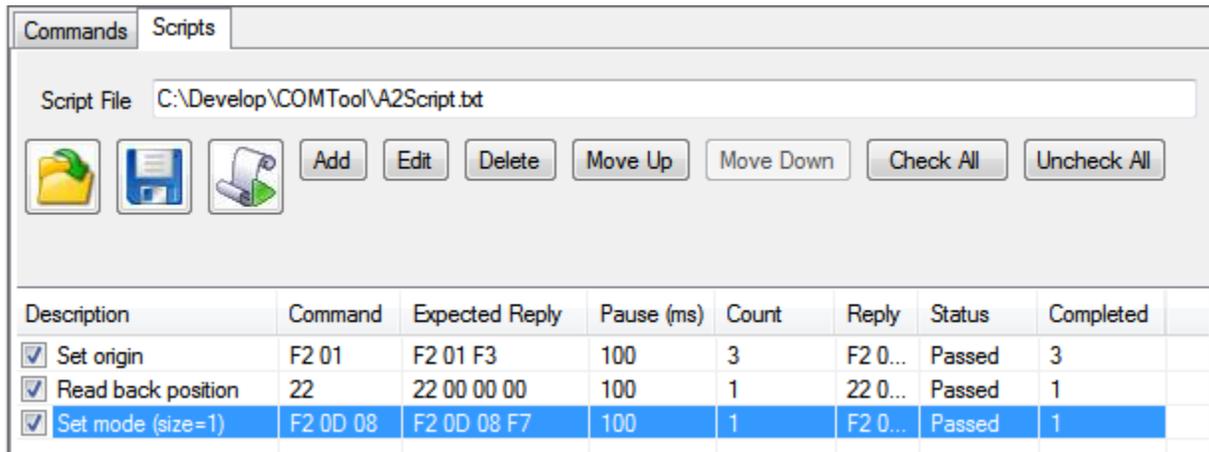
To specify the location of the command database file, click on the open file  button.

To save the device commands to a new database file, click on the save  button.

- The database file contains commands for multiple device types. To filter the commands by device product, click on the Filter by Product checkbox, otherwise commands for all products will be listed.
- To add a command, enter the command description, press tab, enter the command text and then press Enter key. The command will be saved to the database using the selected Product.
- To delete a command, click on the desired command row selector and then press the Delete key. Multiple command rows may be selected and deleted.

COMTool User Guide

Version 1.1
12/02/2013



Scripts Tab

The Scripts tab on the right half of the COMTool application is also used to read, edit, delete, execute, and save commands. The check boxes in front of each command listed allows multiple commands to be selected and executed in a sequence. The list view provides additional status information for each command executed.

The commands can be read from a tab delimited file by clicking on the open button and saved to a file by clicking on the save button.

Each command has the following fields: Description, Command, Expected Reply, Pause, Count, Reply, Status, and Completed.

Description

Field Name	Comment
Description	Identifies the device and what the command does.
Command	Contains the ASCII text or hex bytes that can be sent to a device.
Expected Reply	Contains the ASCII text or hex bytes that are compared with the response from the device.
Pause (ms)	Identifies the number of milliseconds to wait before attempting to read the command reply.
Count	Identifies the number of times to send the command.
Reply	Contains the last command received.
Status	Displays "Unknown" until a command is sent. Displays "Passed" or "Failed" when a command is sent and a reply is received and compared with the expected reply.
Completed	Contains the number of times the specified command was successfully sent and the reply match the Expected Reply.



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COMTool User Guide

Version 1.1
12/02/2013

Adding a New Script Command

To add a new script command, click on the Add button. The Add Script form will appear allowing the user to enter update the script command fields.

Enter a description for the command being added in the Description field. The Command and Expected Reply fields are automatically filled in with the contents of the Transmit and Received fields.

If the command being entered is something like the A2 Read Position command where the first byte is always the same and the last two bytes can vary depending on the encoder position, then the Expected Reply can be modified to match the expected format. The A2 Read Position will reply with a "1F xx xx" value, where the "xx xx" pattern represents the position returned. The following regular expression may be used to match the pattern: `^1F [A-F0-9]{2} [A-F0-9]{2}$`

The "^" indicates the start of a string.

The open and closing brackets "[...]" look for an explicit set of characters to match.

The open and closing braces "{...}" look an explicit number of times the previous qualifier is to be matched.

The "\$" indicates the end of a string.

To test the regular expression, enter a sample reply in the Test Reply field. If the match is successful, then the Test Reply Matches Expected Reply field will display "True" otherwise "False". The Expected Reply and the Test Reply are constantly evaluated as characters are typed into these fields.

To copy and paste the example regular expression in the Expected Reply textbox, click on the Copy + Paste button.

To see more examples on how to use regular expressions, click on the More Help button.

Enter the number of milliseconds to wait before reading the reply in the Pause Delay (ms) field.

Enter the number of times the command is to be executed in the Count Field.



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Version 1.1
12/02/2013

Click OK to accept the changes and add the command to the list view, otherwise click Cancel to ignore the changes.

Add Script Command

Description

Command

1F

Expected Reply (Uses Literal or Regular Expression)

1F 03 6D

Example regular expressions:
Pattern: ^2F 00 [a-fA-F0-9]{2}\s[a-fA-F0-9]{2}\$
2F 00 03 E8 - Matches
2F 00 01 23 45 - Not Matched, remove \$ to allow match.

Use ^ to match start of a string.
Use \$ to match end of a string.

Test Reply Test Reply Matches Expected Reply

Pause Delay (ms) 100 Count 0

OK Cancel

Editing a Script Command

To edit a script command, select the command row and then click to the Edit button. The Edit Script Command dialog will appear containing the same fields and behavior as the Add Script Command dialog.

Deleting a Script Command

To delete a command, select a command row and then click the Delete button.

Reorder Command Sequence

To change the sequence commands are listed and executed, click on either the Move Up or Move Down button.

Selecting Commands to Execute

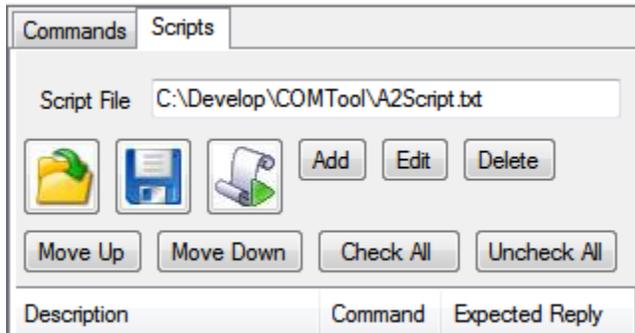
To check all commands, click on the Check All button. To uncheck all commands, click on the Uncheck All button.



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COMTool User Guide

Version 1.1
12/02/2013



Executing a Scripts Command

To execute a script command, ensure that the device is connected and at least one script command is selected and that a Script File is provided then click the run script

 button. The script file is used to identify the log file that is written to when commands are executed. The results of each executed command are written to the log file. The log file name is the same as the script file except the file extension is renamed to .log.

When the script command button is pressed, the status and completed fields are reset for each command that is checked for execution. As each command is executed, it is copied to the Transmit field, the Receive field is cleared, the command is sent, and the process then waits the Pause (in milliseconds) time before comparing the returned results with the Expected Reply. If the comparison matches, then the Status field is updated with "Passed" and the Completed field value is incremented by 1. If the comparison does not match, then the Status field is updated with "Failed" and the next selected command will be executed. The same command can be executed multiple times, as long as the result from each comparison matches the Expected Reply. Completed count shows the number of times the command was successfully executed.

The reply and comparison result of each executed command are written to a log file.

Sample script log file:

8/16/2012 10:19:49 AM	Sent = F2 01	Received = F2 01 F3	Passed = True	Completed= 1
8/16/2012 10:19:49 AM	Sent = 22	Received = 22 00 00 00	Passed = True	Completed= 1
8/16/2012 10:19:50 AM	Sent = F2 0D 08	Received = F2 0D 08 F7	Passed = True	Completed= 1
8/16/2012 10:19:50 AM	Sent = 1F	Received = 1F 00 00	Passed = True	Completed= 1
8/16/2012 10:19:50 AM	Sent = 1F	Received = 1F 00 00	Passed = True	Completed= 2
8/16/2012 10:19:50 AM	Sent = 1F	Received = 1F 00 00	Passed = True	Completed= 3



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COMTool User Guide

Version 1.1

12/02/2013

8/16/2012 10:19:50 AM
8/16/2012 10:19:50 AM

Sent = 1F Received = 1F 00 00
Sent = 1F Received = 1F 00 00

Passed = True
Passed = True

Completed= 4
Completed= 5



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