LIN Serial Analyzer User's Guide Rev2.0

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NOTES:

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Preface

NOTICE TO CUSTOMERS

All documentation becomes dated, and this manual is no exception. Microchip tools and documentation are constantly evolving to meet customer needs, so some actual dialogs and/or tool descriptions may differ from those in this document. Please refer to our web site (www.microchip.com) to obtain the latest documentation available.

Documents are identified with a "DS" number. This number is located on the bottom of each page, in front of the page number. The numbering convention for the DS number is "DSXXXXXA", where "XXXXX" is the document number and "A" is the revision level of the document.

For the most up-to-date information on development tools, see the MPLAB® IDE on-line help. Select the Help menu, and then Topics to open a list of available on-line help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the LIN Serial Analyser. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Recommended Reading
- The Microchip Web Site
- Customer Support
- Document Revision History

DOCUMENT LAYOUT

This document describes how to use the LIN Serial Analyser. The manual layout is as follows:

- **Chapter 1. "LIN Serial Analyser Overview"** – What the LIN Serial Analyser is, what makes it a desirable development tool and what features are available.
- **Chapter 2. "Getting Started – Quick Setup"** – Describes the supplies needed to set up and begin to use the LIN Serial Analyser.
- **Chapter 3. "LIN Serial Analyser PC Program"** – Describes the primary elements of the interface.
- **Appendix A. "LIN Serial Analyzer Technical Information"** – Provides the detailed schematic of the LIN Serial Analyser.

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CONVENTIONS USED IN THIS GUIDE

This manual uses the following documentation conventions:

DOCUMENTATION CONVENTIONS

Description	Represents	Examples
Arial font:		
Italic characters	Referenced books	*MPLAB® IDE User's Guide*
	Emphasized text	...is the *only* compiler...
Initial caps	A window	the Output window
	A dialog	the Settings dialog
	A menu selection	select Enable Programmer
Quotes	A field name in a window or dialog	"Save project before build"
Underlined, italic text with right angle bracket	A menu path	*File>Save*
Bold characters	A dialog button	Click **OK**
	A tab	Click the **Power** tab
N'Rnnnn	A number in verilog format, where N is the total number of digits, R is the radix and n is a digit.	4'b0010, 2'hF1
Text in angle brackets < >	A key on the keyboard	Press <Enter>, <F1>
Courier New font:		
Plain Courier New	Sample source code	`#define START`
	File names	`autoexec.bat`
	File paths	`c:\mcc18\h`
	Keywords	`_asm, _endasm, static`
	Command-line options	`-Opa+, -Opa-`
	Bit values	`0, 1`
	Constants	`0xFF, 'A'`
Italic Courier New	A variable argument	*`file`*`.o`, where *`file`* can be any valid file name
Square brackets [ ]	Optional arguments	`mcc18 [options]` *`file`* `[options]`
Curly brackets and pipe character: { | }	Choice of mutually exclusive arguments; an OR selection	`errorlevel {0|1}`
Ellipses...	Replaces repeated text	`var_name [, var_name...]`
	Represents code supplied by user	`void main (void) { ... }`

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RECOMMENDED READING

This user's guide describes how to use LIN Serial Analyser. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

It is recommended that you become familiar with the documents listed below before using the LIN Serial Analyser.

PICkit™ Serial Analyzer User's Guide (DS51647)

LIN Specification Package 2.1
© LIN Consortium, 2006. http://www.lin-subbus.org.

LIN Network for Vehicle Applications – Surface Vehicle Recommended Practice (J2602/1)

© SAE 2006. http://www.sae.org.

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- **Product Support** – Data sheets and errata, application notes and sample programs, design resources, user's guides and hardware support documents, latest software releases and archived software
- **General Technical Support** – Frequently Asked Questions (FAQs), technical support requests, online discussion groups, Microchip consultant program member listing
- **Business of Microchip** – Product selector and ordering guides, latest Microchip press releases, listing of seminars and events, listings of Microchip sales offices, distributors and factory representatives

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- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support
- Development Systems Information Line

Customers should contact their distributor, representative or field application engineer (FAE) for support. Local sales offices are also available to help customers. A listing of sales offices and locations is included in the back of this document.

Technical support is available through the web site at: http://support.microchip.com.

DOCUMENT REVISION HISTORY

Revision A (June 2007)

- Initial release of this document.

Revision B (June 2008)

- Release describes new features of Revision 2.0 software.

NOTES:

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Chapter 1. LIN Serial Analyser Overview

1.1 INTRODUCTION

The LIN Serial Analyser development system enables a Personal Computer (PC) to communicate with a LIN (Local Interface Network) bus. The PC program uses a graphical user interface to enter and display message frames occurring on the target bus. The LIN Serial Analyser connects to the system network using a three-position terminal block.

Chapter 2. "Getting Started" will guide you through installing the PC program, the Windows® operating system drivers and setting up the hardware.

1.2 HIGHLIGHTS

This chapter discusses:

- LIN Serial Analyser Contents
- LIN Serial Analyser Development Tool
- LIN Serial Analyser Hardware
- LIN Serial Analyser Software

1.3 LIN SERIAL ANALYSER CONTENTS

The LIN Serial Analyser kit contains the following items:

- LIN Serial Analyser
- Mini-B USB Cable
- LIN Serial Analyser CD-ROM

1.4 LIN SERIAL ANALYSER DEVELOPMENT TOOL

The LIN Serial Analyser consists of several components, that together, make a network debug and analysis tool. The user interface program runs on Microsoft® Windows® operating system compatible computers with a USB port.

The LIN Serial Analyser connects to the PC using a mini-B USB cable. The LIN Serial Analyser interfaces to the target network using a three-position, screw-type terminal block. Figure 1-1 illustrates the LIN Serial Analyser tool connected to a network.

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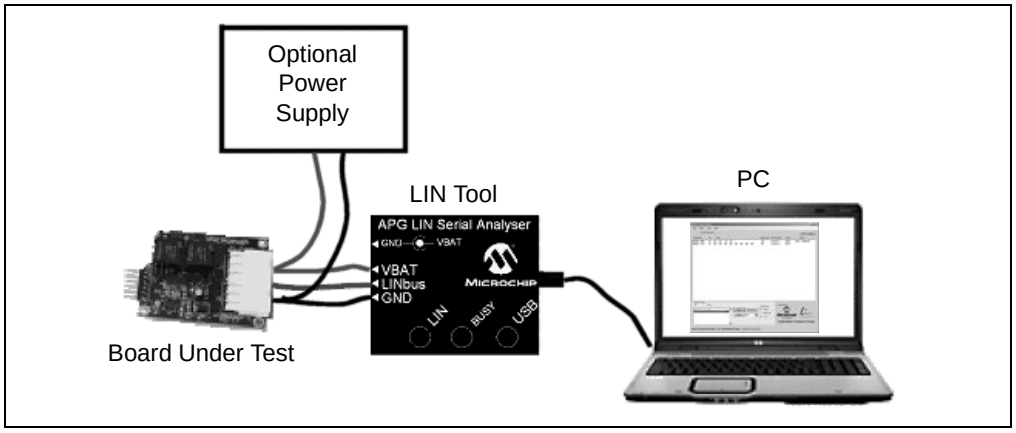
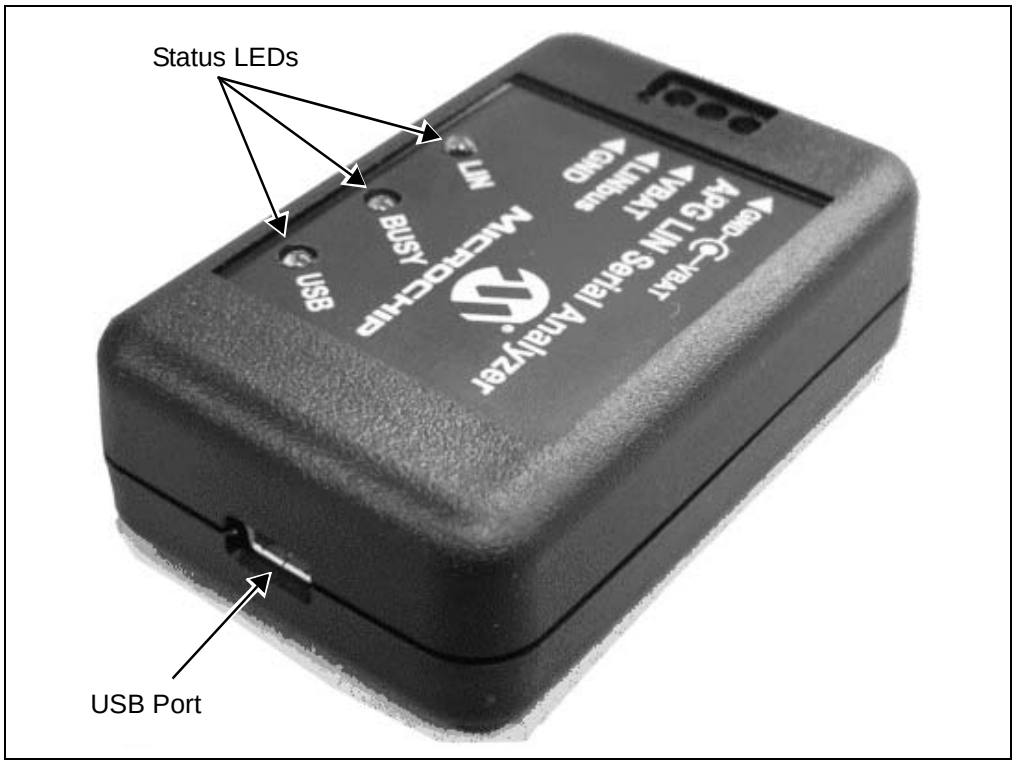
FIGURE 1-1: LIN SERIAL ANALYSER DEVELOPMENT TOOL



1.5 LIN SERIAL ANALYSER HARDWARE

The LIN Serial Analyser connects to a Microsoft® Windows® operating system compatible computer using a USB port. It interfaces to the target network using a three-position, screw-type terminal block.

FIGURE 1-2: LIN SERIAL ANALYSER



1.5.1 Status LEDs

The Status LEDs indicate the status of the LIN Serial Analyser. An illuminated LED means:

- USB (green) – Power has been applied to the LIN Serial Analyser by the USB port.
- Busy (yellow) – The LIN Serial Analyser is communicating with the LIN network.
- LIN (blue) – The LIN Serial Analyser is connected to the target bus.

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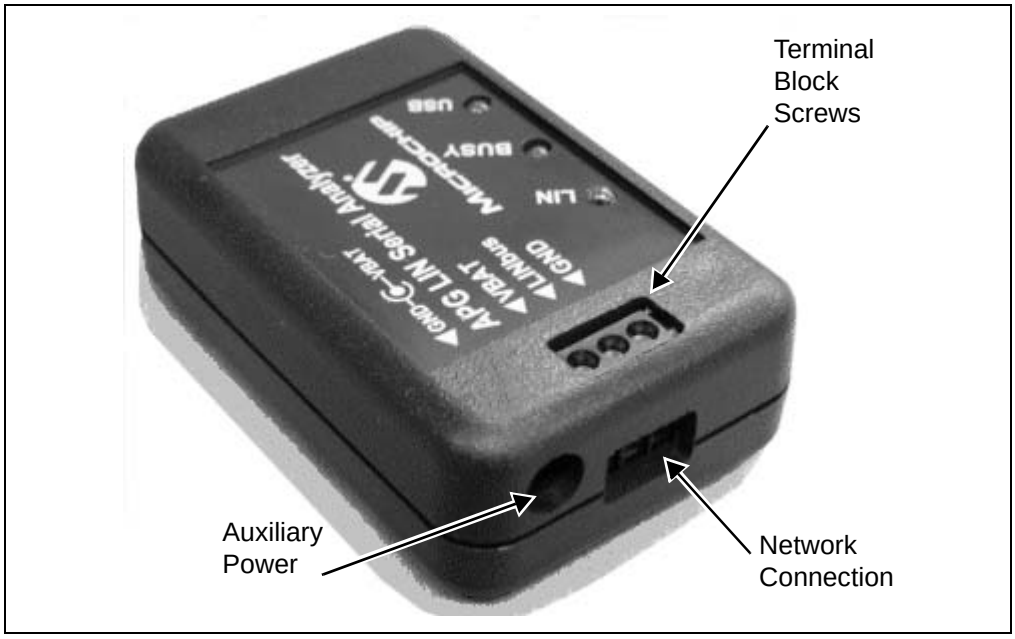
1.5.2 USB Port Connection

The USB port connection is a USB mini-B connector. Connect the LIN Serial Analyser to the PC using the cable supplied with the device.

FIGURE 1-3: LIN SERIAL ANALYSER NETWORK AND POWER



1.5.3 Network Communication Connector

The communication connector connects to the target device using a three-position, screw clamp terminal block. The pin assignments, labeled on the top of the device, are:

- VBAT – Positive battery connection for voltage supplied by the vehicle
- LIN – Bidirectional data I/O
- GND – Common chassis, power and serial ground

1.5.4 Power Jack

The device uses a standard, 6.5 x 2.5 DC power plug. The center pin is positive. Power can be supplied either through the power plug or the network connector as the two are internally connected.

1.6 LIN SERIAL ANALYSER SOFTWARE

1.6.1 User Interface Program

The LIN Serial Analyser PC program displays all of the board's bus activity via the software's Transaction window, displayed on the connected PC. This is useful for "sniffing" the bus and tracking message frames.

Chapter 3. "LIN Serial Analyser PC Program" explains the installation and operation of the program.

1.6.2 Firmware

The LIN Serial Analyser firmware is explained in **Chapter 9. "PICkit™ Serial Analyzer Firmware"** of the *"PICkit™ Serial Analyzer User's Guide"* (DS51647).

1.6.3 Dynamically Linked Library (DLL)

The LIN Serial Analyser DLL is explained in **Chapter 10. "PICkit™ Serial Analyzer DLL"** of the *"PICkit™ Serial Analyzer User's Guide"* (DS51647).

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Chapter 2. Getting Started – Quick Setup

2.1 HIGHLIGHTS

This chapter discusses:

- Using the LIN Serial Analyzer for the First Time
- Software Installation
- Running LIN Serial Analyser Program

2.2 USING THE LIN SERIAL ANALYZER FOR THE FIRST TIME

The LIN Serial Analyser is shipped preprogrammed and ready for use. The user needs to supply:

- A wiring harness with appropriate connections to its system network
- A power supply (nominal 13.8V)

Before making any connections, the software must be installed on the host system. The user must have administrator level rights to install some of the required programs. For more information, see **Section 2.3 "Software Installation"**.

Power is supplied either through the round, power plug or the terminal block. The positive and negative terminals and power plug are common. Supplied power must be in the range of 8.0V to 30.0V with a nominal value of 12.0-14.4V. Less than 5.0 mA of current is required to power the LIN transceiver section of the unit.

Internal jumper, E1, configures the unit as either a master or slave node. A 1.0 kΩ bus pull-up resistor is enabled when E1 is connected across A and B. With the jumper removed, an internal 30 kΩ resistor is retained.

The unit is configured as a master node as shipped.

2.3 SOFTWARE INSTALLATION

All necessary files are contained on the Compact Disc (CD) supplied with the device.

2.3.1 Installing the LIN Serial Analyser Program

1. Run `setup.exe` from the CD.
2. Select **Install** when prompted and follow any instructions.

> **Note:** The LIN Serial Analyser program requires the Microsoft® .NET Framework version 2.0.

The PC host program is uninstalled with the control panel's add/remove utility.

2.4 RUNNING LIN SERIAL ANALYSER PROGRAM

Before starting the LIN Serial Analyser software:

- The analyzer must be connected to the PC by a USB cable
- The analyzer must be powered up

The analyzer's green **USB** and blue **LIN** lights will be on when these conditions are met.

There is a hard-wired, loopback bus path, so connection to a network is not needed for testing the installation.

To start the software:

1. On the Windows operating system taskbar, click **Start**.
2. Click *All Programs>Microchip Technology Inc.>*LIN Serial Analyser.
3. Click *Setup>COM port*.
4. From the pull-down menu, select the USB port to be used.

Note:	Only available, plugged in USB ports are displayed by the pull-down menu. If the correct serial port is not displayed, verify that the USB hardware is correctly installed.

5. In the menu's text box, type the appropriate baud rate value.
6. Click **OK**.
7. Verify operation by selecting one of the preset messages from the Master Message area.

   Bus activity is indicated by the analyzer's yellow **BUSY** light flickering.

   A message will be displayed in the Bus Transaction window with:

   - A time-stamp
   - The correct ID parity bits
   - The calculated checksum
   - Any detected error conditions

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Chapter 3. LIN Serial Analyser PC Program

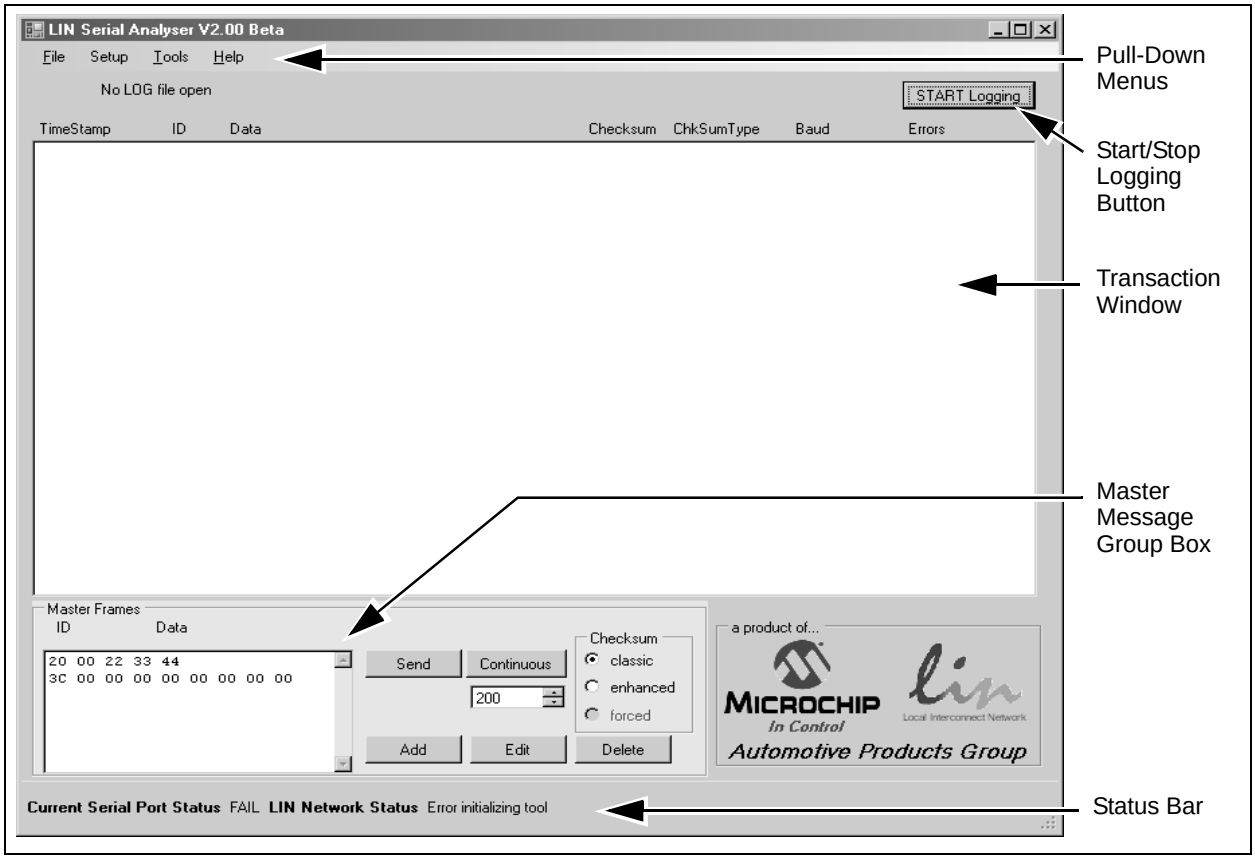
3.1 HIGHLIGHTS

This chapter discusses:

- Interface Overview
- Transaction Window
- File Functions
- Setup Functions
- Tools Functions
- Start/Stop Logging Button
- Master Message Group Box
- Status Bar

3.2 INTERFACE OVERVIEW

When the LIN Serial Analyser's software program starts, the window, shown in Figure , appears. The commands are accessed through the pull-down menus at the top of the interface.LIN Serial Analyzer User Interface



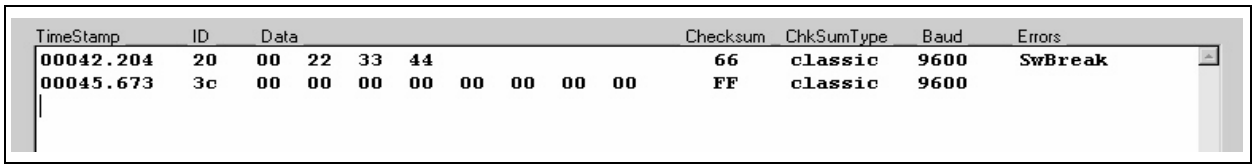
3.3 TRANSACTION WINDOW

This window, shown in Figure 3-1, constantly monitors and display bus traffic when in the "Display All" mode. Any message frames seen on the bus are shown, regardless of the source.

The data is displayed as it is seen on the bus without modification.

This section describes the window's fields.

FIGURE 3-1: MESSAGE FRAMES DISPLAY



3.3.1 TimeStamp

This field of the Transaction window displays the time, in seconds, since the last frame was received. The value is reset to zero when the window is cleared.

The value can also be cleared by clicking on the "TimeStamp" column label.

3.3.2 ID (Identifier)

This field displays the ID byte, including the upper two parity bits.

3.3.3 Data

From zero to eight data bytes are displayed in this field. The data is in the hexadecimal format (without the leading characters, '0x'), with the bytes separated by spaces.

3.3.4 Checksum

The last field of a frame is the checksum. The checksum contains the inverted, eight-bit sum with carry, over all data bytes or all data bytes and the protected identifier.

3.3.5 ChkSumType

This field indicates whether a "classic" or "enhanced" equation was used for the checksum calculation. For messages sent via the Master Message group box, the type of calculation is configured in the checksum portion of the Master Message group box (see **Section 3.8.3 "Checksum Group"**).

- Classic – Checksum calculation over the data bytes only. Used for the master request frame, slave response frame and communications with LIN 1.x slaves.

  An eight-bit sum with carry is equivalent to the sum of all values and subtracts 255 every time the sum is greater than or equal to 256.
- Enhanced – Checksum calculation over the data bytes and the protected identifier byte. Used for communication with LIN 2.x slaves.

The checksum is calculated both ways when a message frame is received. A match is displayed either as "Classic" or "Enhanced". If neither result matches the incoming data, "ERROR" is displayed.

3.3.6 Baud

This field shows the actual, calculated bit rate observed during the Auto-Baud Detect period of the current frame.

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3.3.7 Errors

This field displays any of the error types described in this section. If multiple errors are detected, only one is displayed.

3.3.7.1 PARITY

The parity is calculated on the frame identifier bits as shown in Equation 3-1.

EQUATION 3-1: PARITY CALCULATIONS†

P0 = ID0 ℘? ID1 ℘? ID2 ℘?
P1 = - (ID1 ℘? ID3 ℘? ID4 ℘? I

† P0 is bit 6 and P1 is bit 7 of the ID byte.

3.3.7.2 TX BIT

A slave or master node that is transmitting a bit on the bus also monitors the bus. A TX bit error is when the bit or byte value that is received is different from the bit or byte value that is transmitted.

Note: This function is not currently implemented.

3.3.7.3 CHECKSUM

A checksum error is when the inverted modulo-256 sum over all received data bytes and the protected identifier (when using enhanced checksum) and the received checksum byte field does not result in $FF.

3.3.7.4 FRAMING

A byte field framing error is when the ninth bit after a valid Start bit is dominant. This check does not apply to the Break character.

Note: This function is not currently implemented.

3.3.7.5 NO ANSWER

This value displays when a new Break/Sync/ID header was detected, but no data was received within the bus time-out period.

3.3.7.6 BREAK

This displays when data characters were received before a valid Sync Break header was detected.

Note: This function is not currently implemented.

3.3.7.7 BUS TIME-OUT

This value indicates that the time interval allocated for an eight-byte message expired. This time is set to approximately 140% of a single bit time.

The time-out may also be configured to a fixed value not dependent on baud rate.

3.3.7.8 SWBREAK

This value displays when a valid Sync Break is not detected by the UART. A Break was “assumed” because the first byte received was 0x00, but without a framing error.

Note: This function is not currently implemented.

3.4 FILE FUNCTIONS

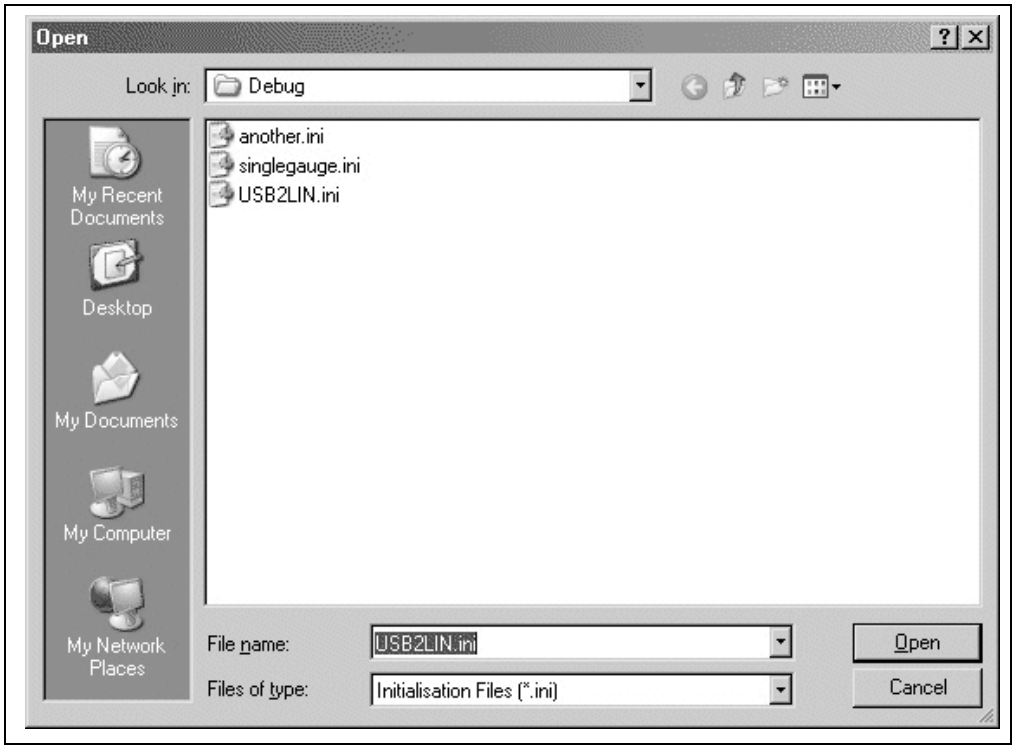
3.4.1 Open

The "Open" dialog box loads configuration and master message frames from a user-selected file into the "Master Frames" field, so that they can be sent (see **Section 3.8.1 "Master Frames Field"**).

By default, the dialog box, shown in Figure 3-2, displays the file that was last used in the previous session.

To display the dialog box, go to the pull-down menus at the top of the user interface and select *File>Open*.

FIGURE 3-2: FILE OPEN WINDOW



3.4.2 Save

The "Save" dialog box saves configuration and master message frames, displayed in the "Master Frames" field, to a previously selected `*.ini` file (see **Section 3.8.1 "Master Frames Field"**.) By default, the dialog box populates the file name that was last used in the previous session.

To display the dialog box, go to the pull-down menus at the top of the user interface and select *File>Save*.

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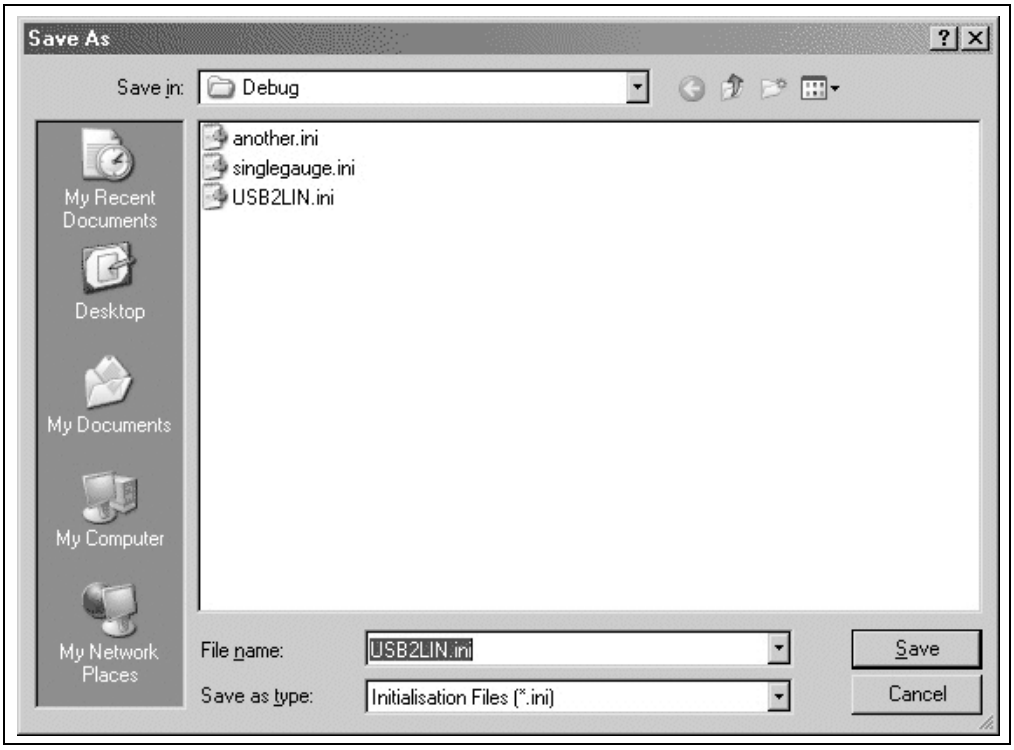
3.4.3 Save As

The “Save As” dialog box saves or appends configuration and master message frames, displayed in the “Master Frames” field, to a preselected file (see **Section 3.8.1 “Master Frames Field”**). The default file name is the last used file from the previous session.

To display the dialog box, shown in Figure 3-3, go to the pull-down menus at the top of the user interface and select *File>Save As*.

FIGURE 3-3: FILE “Save As” WINDOW



3.4.4 Print, Print Setup, Print Preview

These three functions relate to printing the contents of the Transaction window. *Print Setup* configures the printing attributes and *Print Preview* displays how the print will appear.

The printing function clears the contents of the Transaction window, but does not reset the time-stamp.

All of these functions are accessible through the *File* pull-down menu.

3.4.5 Exit

Selecting *File>Exit* terminates the LIN Serial Analyser software program.

3.5 SETUP FUNCTIONS

The Tools pull-down menu has the following commands.

3.5.1 Setup COM port

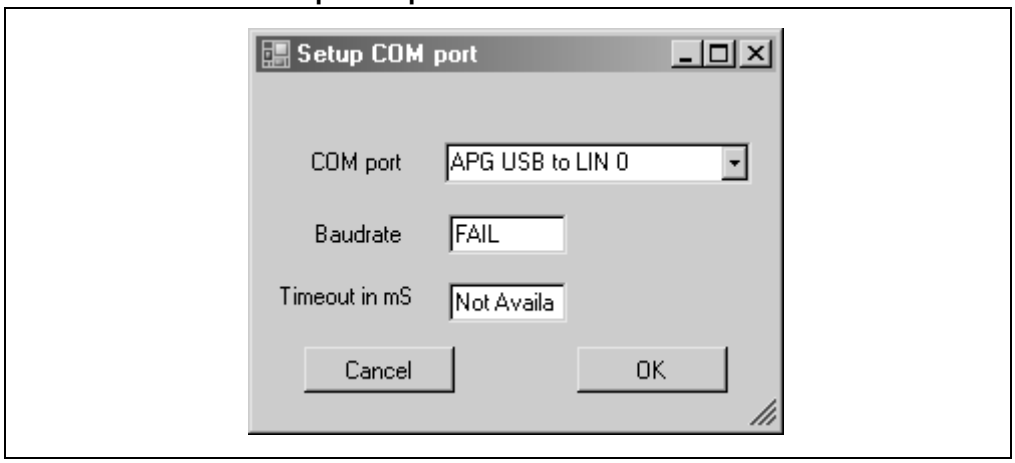
The "Setup COM port" function selects the USB communication port to use.

Note:	The "COM port" drop-down list box displays only available, plugged-in USB ports. If the correct serial port is not displayed in the menu, verify that the USB hardware is correctly installed.

The menu also sets the baud rate to apply to master transactions.

The "Timeout in mS" text box displays the current time-out value for a message frame and may be modified by the user. To enable the time-out value to vary with the baud rate, enter a value of 0.

FIGURE 3-4: "Setup COM port" WINDOW



To display the dialog box, select *Setup>COM port*.

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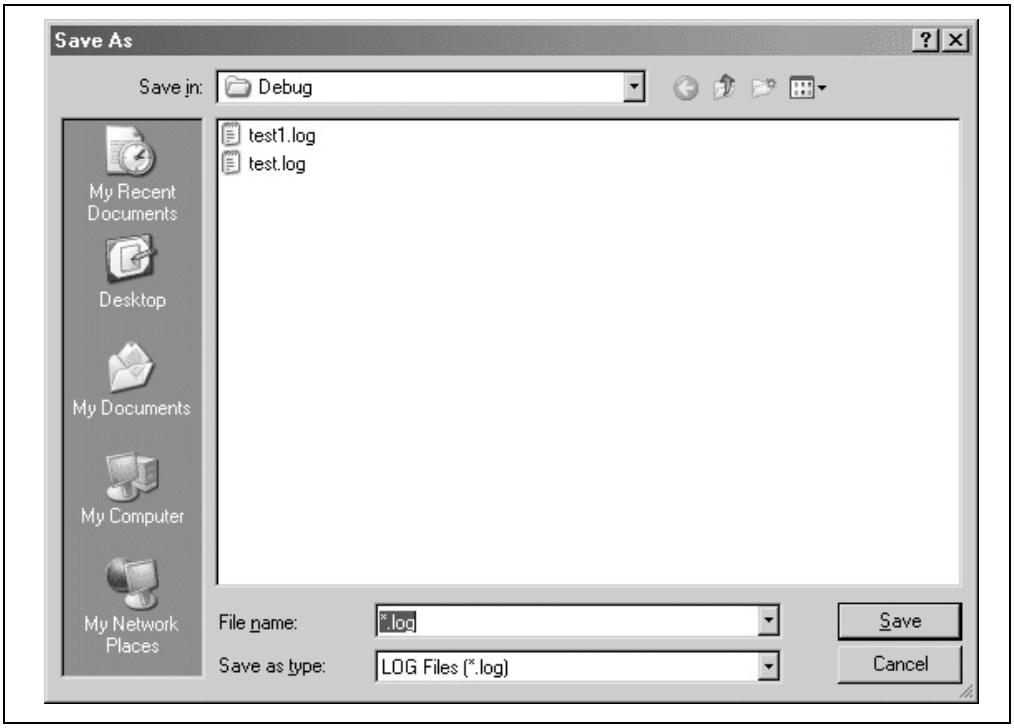
3.5.2 Log File

The Log File setup function specifies the new or existing file that will store bus transactions.

If an existing file that already contains data is selected, any new messages will be appended to the end of the file.

FIGURE 3-5: LOG FILE SETUP WINDOW

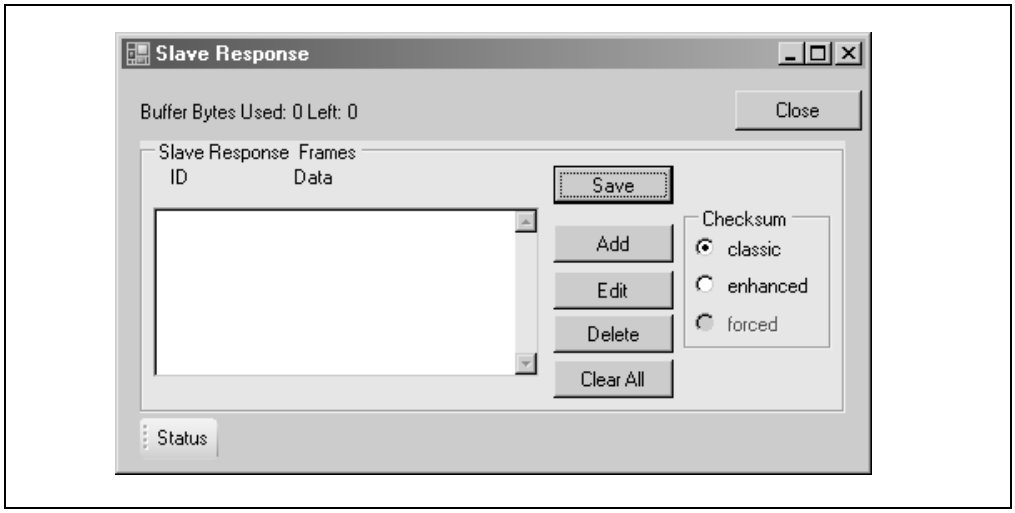


To display the dialog box, select *Setup>Log File*.

3.5.3 Slave Response

The Slave Response setup function specifies message frames that are published to the bus whenever the correct ID is recognized.

FIGURE 3-6: SLAVE RESPONSE SETUP WINDOW



To display the dialog box, select *Setup>Slave Response*.

3.5.4 Slave Response Frames Field

The "Slave Response Frames" field is composed of 0 to *n* rows of one or more messages that are sent over the bus in response to a valid ID byte. These messages can be entered manually, loaded from a previously saved session, or both.

When the response is sent, it is displayed in the Transaction window if it is open and active.

Messages in the "Slave Response Frames" field can also be saved for reuse (see **Section 3.4.2 "Save"** and **Section 3.4.3 "Save As"**).

3.5.4.1 RESPONSE SYNTAX

Messages must consist of the ID byte without parity bits and the data bytes, all separated by spaces. All inputs are in hexadecimal radix.

The checksum is not included; it is calculated at send time unless the "forced" Checksum option is selected.

Comments or notes may be attached to each frame by prefacing it with a semi-colon (;). Any text after the semi-colon will be disregarded and not transmitted. All notes will be saved in the selected `.ini` file and reloaded when reopened.

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3.5.4.2 DEVELOPING AND STORING RESPONSE CONTENT

To *manually* add a slave response message content to the “Slave Response Frames” field:

1. Click the **Add** button. A second window displays for creation of the new message.
2. Type the message in the text box.
3. Click **OK**.

To *load* a pre-existing message to the “Slave Response Frames” field:

WARNING
Importing a file into the “Slave Response Frames” field overwrites any content that previously had been in that field.

1. From the pull-down menus, select *File>Open*. The “Open” dialog box appears.
2. In the dialog box’s list box, select the desired `*.ini` file.
3. Click **Open**.

To *delete* some slave message content:

1. In the “Slave Response Frames” field, select the content to be deleted by doing one of the following:
   - To *select adjacent rows of content* – Click on the first row, scroll down to the last row and hold down <Shift> while clicking.
   - To *select non-adjacent rows of content* – Hold down <Ctrl> while clicking each row.
2. Click **Delete**.

To *edit* some slave message content:

1. In the “Master Frames” field, select the content line to be edited
1. Click **Edit.** A second window displays to edit hte message.
2. Make and corrections or additions to the message in the text box.
3. Click **OK**

To *store* a slave response message(s) into the buffer:

1. In the “Slave Responser Frames” field, select the content to be stored by doing one of the following:
   - To *select adjacent rows of content* – Click on the first row, scroll down to the last row and hold down <Shift> while clicking.
   - To *select non-adjacent rows of content* – Hold down <Ctrl> while clicking each row.
2. Click **Save**.

   The highlighted message content is stored, working top-to-bottom through the “Slave Response Frames” field.

   The internal buffer status is updated to reflect the amount a bytes used and remaining. If the amount of buffer space is exceeded, the **Save** operation is aborted and a error message displayed. Reduce the number or size of the messages to be written to the buffer and retry the **Save**.

To *save* a slave reponse message to a file:

1. See **Section 3.4.2 "Save"** and **Section 3.4.3 "Save As"**.

3.5.4.3 SLAVE RESPONSE FRAMES FIELD ELEMENTS

This section describes the "Slave Response Frames" field's two elements.

3.5.4.3.1 ID

The "ID" element displays the identifier byte that is compared to identifier bytes received from the bus. The ID is entered without the upper two parity bits. Parity is calculated and appended when the message frame is stored in the inernal buffer memory. The acceptable range of values is 00 to 3F hex (0 to 63 decimal).

3.5.4.3.2 DATA

The "Data" portion of the "Slave Response Frames" field displays zero to eight-byte values, separated by spaces. This are the actual bytes sent over the bus in response to a recognized ID.

3.5.5 Slave Response Message Controls

3.5.5.1 SAVE BUTTON

Clicking this button stores the selected message content highlighted in the "Slave Response Frames" field (see the "Save" procedure in **Section 3.5.4.2 "Developing and Storing Response Content"**).

3.5.5.2 ADD BUTTON

Click the Add button to add a new message to the "Slave Response" field

3.5.5.3 EDIT BUTTON

Allows the selected message in the "Slave Response Frames" field to be edited.

3.5.5.4 DELETE BUTTON

Clicking the **Delete** button deletes the content that is highlighted in the "Master Frames" field. (see the "Delete" procedure in **Section 3.5.4.2 "Developing and Storing Response Content"**).

3.5.5.5 CLEAR ALL BUTTON

Clicking this button clears the both the contents of the "Slave Response Frames" window and the internal buffer memory. The buffer status is updated to show no used bytes and bytes remaining.

3.5.6 Checksum Group

The checksum value is computed at send time. Selecting one of the option buttons in the "Checksum" group, shown at right, determines the type of checksum that will be calculated for all transmitted master message frames, highlighted in the "Master Frames" field.

- **classic** – The checksum includes all data bytes.
- **enhanced** – The checksum includes identifier byte and all data bytes.
- **forced** – (Enabled only in Debug mode.) The last byte in the message string is sent in place of the calculated checksum. This is useful in checking master error handling.

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The checksum returned by the slave will be displayed in the “Checksum” field of the Transaction window (see **Section 3.3.5 “ChkSumType”**.)

3.6 TOOLS FUNCTIONS

This sections lists the commands on the Tools pull-down menu.

3.6.1 Debug Mode

Selecting *Tools>Debug Mode* enables the user to debug bus or slave operational issues.

One function forces a user-supplied checksum to be appended to a master message to check a slave for proper error handling. In this mode, the generation of identifier parity bits is inhibited and the identifier byte is transmitted without modification.

3.6.2 Suppress Bus Time-out Error

The current implementation of the master task cannot refer to a LIN descriptor file, so there is no way to determine the length of any received message. To calculate an appropriate time-out value, multiply the length of an eight-byte frame times 140% of the bit rate.

This value can be overridden by entering a fixed time-out value in the COM Setup window, described in **Section 3.5.1 "Setup COM port"**.

3.6.3 Clear Monitor Window

This function clears the Transaction window and resets the time-stamp.

3.6.4 Filters

This opens a window to display all messages received through the Transaction window but are sorted by ID number. The window is 'live' and shows current bus traffic. New message frames received will overwrite previous data. This is useful in monitoring constanly changes data.

3.6.5 Transmit

This option selects the Transmit Only mode. No received messages are displayed in the Transaction window.

3.6.6 Listen (Filter)

This option selects the Listen Only mode. Only non-duplicated messages are displayed in the Transaction window.

When "snooping" bus message frames, this prevents the Transaction window from becoming cluttered with repeated frames.

3.6.7 Display All (Snoop) Default

This function selects the Display All mode. All messages seen on the bus are displayed.

This mode is best used with the data logging feature to capture all bus traffic for later analysis.

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3.7 START/STOP LOGGING BUTTON

This button – located in the top, right corner of the interface – starts, pauses, or stops the capturing of messages to the log file.

Before starting the logging process, select and open a log file (see **Section 3.5.2 “Log File”**).

To pause the logging process, click the button a second time.

3.8 MASTER MESSAGE GROUP BOX

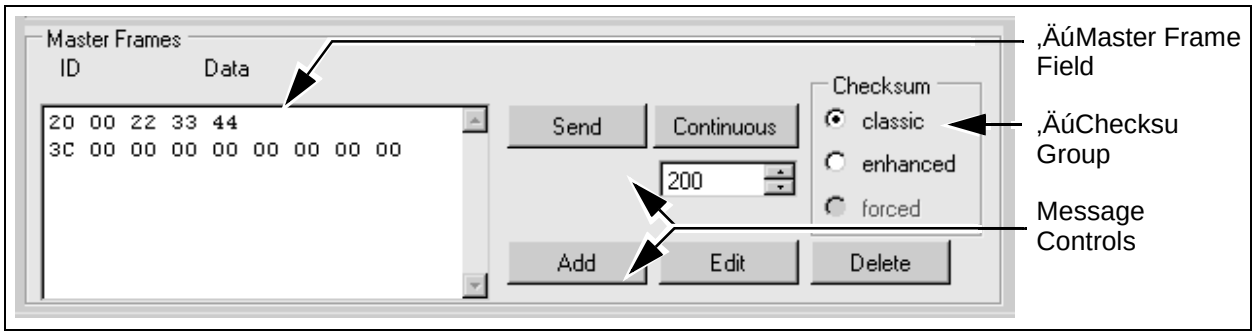
This functions in the group box to act as a master node on the LIN bus, sending the previously constructed frames to the slaves on the bus.

This window will cause a bus conflict if another master appears on the network. Any conflict will be shown in an active Transaction window as a bus error.

The group box, shown in Figure 3-7, consists of the:

- “Master Frames” field
- “Checksum” group
- Message controls

FIGURE 3-7: MASTER MESSAGE GROUP BOX



3.8.1 Master Frames Field

The “Master Frames” field is composed of 0 to *n* rows of one or more messages that can be sent over the bus for test purposes. These messages can be entered manually, loaded from a previously saved session, or both.

When the message is sent, it and any response is displayed in the Transaction window if it is open and active.

Messages in the “Master Frames” field can also be saved for reuse (see **Section 3.4.2 “Save”** and **Section 3.4.3 “Save As”**).

3.8.1.1 MESSAGE SYNTAX

Messages must consist of the ID byte without parity bits and the data bytes, all separated by spaces. All inputs are in hexadecimal radix.

The checksum is not included; it is calculated at send time.

Comments or notes may be attached to each frame by prefacing it with a semi-colon (;). Any text after the semi-colon will be disregarded and not transmitted. All notes will be saved in the selected `.ini` file and reloaded when reopened.

3.8.1.2 DEVELOPING AND STORING MESSAGE CONTENT

To *manually* add message content to the "Master Frames" field:

1. Click the **Add** button. A second window displays for creation of the new message.
2. Type the message in the text box.
3. Click **OK**.

To *load* a pre-existing message to the "Master Frames" field:

WARNING

Importing a file into the "Master Frames" field overwrites any content that previously had been in that field.

1. From the pull-down menus, select *File>Open*. The "Open" dialog box appears.
2. In the dialog box's list box, select the desired `*.ini` file.
3. Click **Open**.

To *delete* some message content:

1. In the "Master Frames" field, select the content to be deleted by doing one of the following:
   - To *select adjacent rows of content* – Click on the first row, scroll down to the last row and hold down <Shift> while clicking.
   - To *select non-adjacent rows of content* – Hold down <Ctrl> while clicking each row.
2. Click **Delete**.

To *edit* some message content:

1. In the "Master Frames" field, select the content line to be edited
1. Click **Edit.** A second window displays to edit hte message.
2. Make and corrections or additions to the message in the text box.
3. Click **OK**

To *send* a message:

1. In the "Master Frames" field, select the content to be sent by doing one of the following:
   - To *select adjacent rows of content* – Click on the first row, scroll down to the last row and hold down <Shift> while clicking.
   - To *select non-adjacent rows of content* – Hold down <Ctrl> while clicking each row.
2. Click **Send**.

   The highlighted message content is sent, working top-to-bottom through the "Master Frames" field.

   The message is sent once. (For information on *continually sending* the highlighted message content, see **Section 3.8.3 "Checksum Group"**.)

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To *store* a message:

1. See **Section 3.4.2 “Save”** and **Section 3.4.3 “Save As”**.

3.8.1.3 MASTER FRAMES FIELD ELEMENTS

This section describes the “Master Frames” field’s two elements.

3.8.1.3.1 ID

The “ID” element displays the identifier byte to be sent without the upper two parity bits. Parity is calculated and appended at send time unless the application is in the Debug mode (see **Section 3.6.1 “Debug Mode”**).

The acceptable range of values is 00 to 3F hex (0 to 63 decimal).

3.8.1.3.2 DATA

The “Data” portion of the “Master Frames” field displays zero to eight-byte values, separated by spaces.

3.8.2 Message Controls

3.8.2.1 SEND BUTTON

Clicking this button transmits the message content that is highlighted in the “Master Frames” field (see the “Send” procedure in **Section 3.8.1.2 “Developing and Storing Message Content”**).

When the **Send** button is clicked, the message is sent once (see **Section 3.8.3 “Checksum Group”**).

If the Transaction window is open and active, the message and any response will be displayed.

3.8.2.2 CONTINUOUS BUTTON

Clicking the **Continuous** button sends the selected message entry or entries continuously, at an interval defined in the time control text box, described next. A second click of the button stops the continuous transmissions.

Any number of messages may be selected for continuous broadcast. They will be transmitted in the order they appear in the “Master Frames” field.

3.8.2.3 TIME CONTROL

Used in conjunction with the **Continuous** button, this text box sets the interval, in milliseconds, between message frames being sent in the Continuous mode.

Note:	Due to service latency time in the Windows operating system environment, the minimum time interval may be as high as 200 ms, regardless of desired time set in the control box. Intervals less than 200 ms will be serviced as fast as possible, but may not be less than the operating system minimum.

3.8.2.4 ADD BUTTON

Click the Add button to add a new message to the “Master Frames” field

3.8.2.5 EDIT BUTTON

Allows the selected message in the “Master Frames” field to be edited.

3.8.2.6 DELETE BUTTON

Clicking the **Delete** button deletes the content that is highlighted in the "Master Frames" field. (see the "Delete" procedure in **Section 3.8.1.2 "Developing and Storing Message Content"**).

3.8.3 Checksum Group

The checksum value is computed at send time. Selecting one of the option buttons in the "Checksum" group, shown at right, determines the type of checksum that will be calculated for all transmitted master message frames, highlighted in the "Master Frames" field.

- **classic** – The checksum includes all data bytes.
- **enhanced** – The checksum includes identifier byte and all data bytes.
- **forced** – (Enabled only in Debug mode.) The last byte in the message string is sent in place of the calculated checksum. This is useful in checking slave error handling.

If a slave response is requested (a ID value with no data bytes), the checksum is not computed and the field is left blank.

The checksum returned by the slave will be displayed in the "Checksum" field of the Transaction window (see **Section 3.3.5 "ChkSumType"**.)

3.9 STATUS BAR

The status bar at the bottom of the Interface window displays:

- Currently selected baud rate of master messages
- Dynamic LIN network status

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Appendix A. LIN Serial Analyzer Technical Information

A.1 HIGHLIGHTS

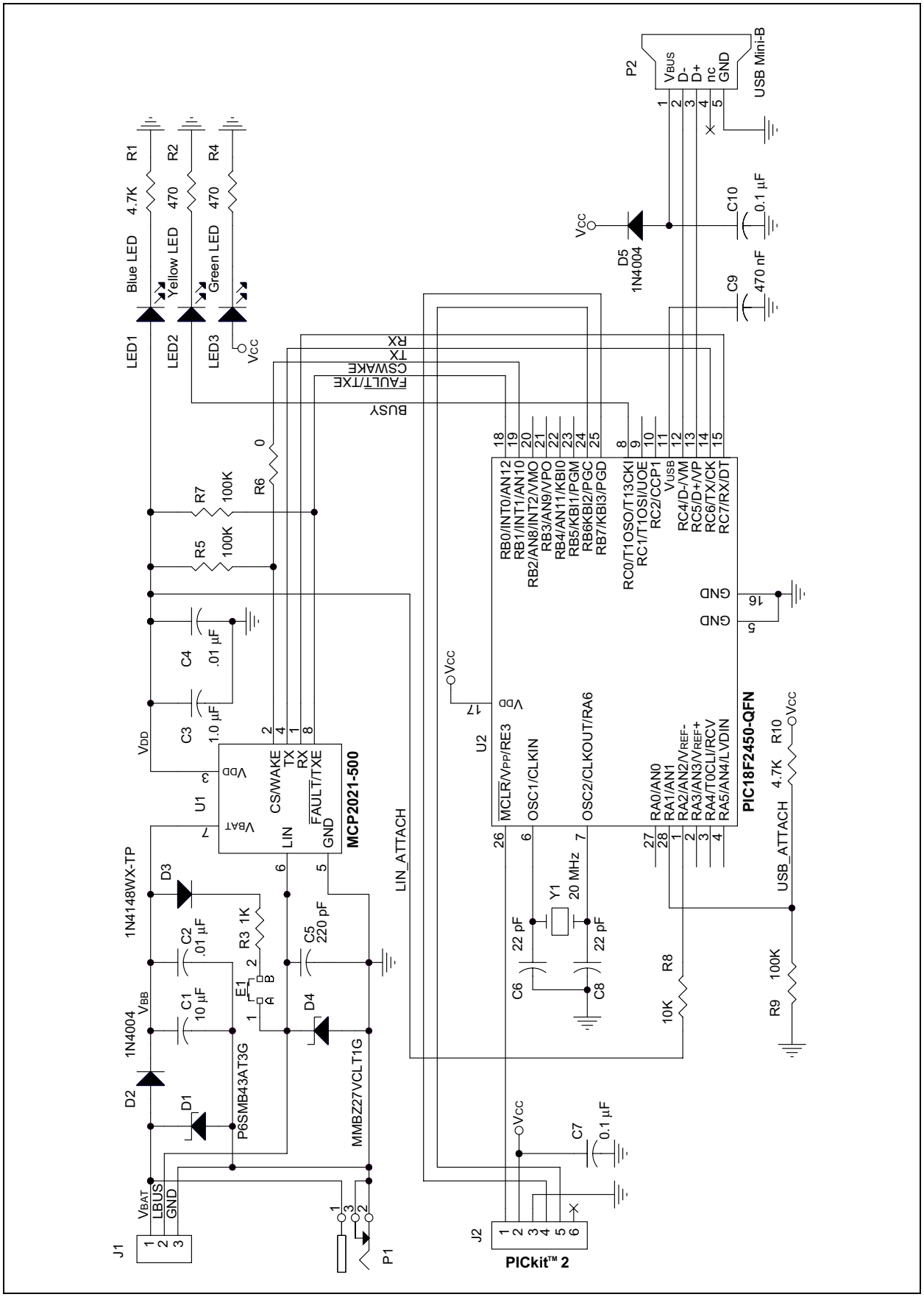
This chapter discusses:

- LIN Serial Analyzer Schematic

A.2 LIN SERIAL ANALYZER SCHEMATIC

The LIN Serial Analyzer management hardware diagram is shown in Figure A-1.

FIGURE A-1: LIN SERIAL ANALYZER SCHEMATIC



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105318, г.Москва, ул.Щербаковская д.3, офис 1107, 1118, ДЦ «Щербаковский»

Телефон: +7 495 668-12-70 (многоканальный)

Факс: +7 495 668-12-70 (доб.304)

E-mail: info@moschip.ru

Skype отдела продаж:
moschip.ru
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moschip.ru_6
moschip.ru_9