Lighting Communications Development Platform User's Guide

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LIGHTING COMMUNICATIONS DEVELOPMENT PLATFORM USER'S GUIDE

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Object of Declaration: Lighting Communications Development Platform (DM160214, AC160214, AC160214-1, AC160214-2, DV160214-1, DV160214-2)

EU Declaration of Conformity

This declaration of conformity is issued by the manufacturer.
The development/evaluation tool is designed to be used for research and development in a laboratory environment. This development/evaluation tool is not a Finished Appliance, nor is it intended for incorporation into Finished Appliances that are made commercially available as single functional units to end users under EU EMC Directive 2004/108/EC and as supported by the European Commission's Guide for the EMC Directive 2004/108/EC (8th February 2010).
This development/evaluation tool complies with EU RoHS2 Directive 2011/65/EU.
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Signed for and on behalf of Microchip Technology Inc. at Chandler, Arizona, USA

Derek Carlson
VP Development Tools

16-July-2013
Date

NOTES:

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 online help. Select the Help menu, and then Topics to open a list of available online help files.

INTRODUCTION

This chapter contains general information that will be useful to know before using the Lighting Communications Development Platform. Items discussed in this chapter include:

- Document Layout
- Conventions Used in this Guide
- Warranty Registration
- Recommended Reading
- The Microchip Web Site
- Development Systems Customer Change Notification Service
- Customer Support
- Revision History

DOCUMENT LAYOUT

This document describes how to use the Lighting Communications Development Platform as a development tool to emulate and debug firmware on a target board, as well as how to program devices. The document is organized as follows:

- **Chapter 1. "Overview"**
- **Chapter 2. "Main Board (DM160214)"**
- **Chapter 3. "Prototyping Board (AC160214)"**
- **Chapter 4. "DALI Adapter (AC160214-1)"**
- **Chapter 5. "DMX512A Adapter (AC160214-2)"**

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`
	Filenames	`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 filename
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) { ... }`

WARRANTY REGISTRATION

Please complete the enclosed Warranty Registration Card and mail it promptly. Sending in the Warranty Registration Card entitles users to receive new product updates. Interim software releases are available at the Microchip web site.

RECOMMENDED READING

This user's guide describes how to use Lighting Communications Development Platform. Other useful documents are listed below. The following Microchip documents are available and recommended as supplemental reference resources.

- *Digitally Addressable Lighting Interface (DALI) Communication* (DS01465) – It has emerged as a standard in Europe to address growing power issues, mostly for commercial and industrial purposes. DALI is part of the IEC 60929 specification and is increasing in popularity around the world. This application note provides a general overview of DALI.
- *DALI Control Gear* (AN1487) – This application note explains the implementation of some DALI commands on the control gear, how commissioning is performed, as well as the modes of operation.

THE MICROCHIP WEB SITE

Microchip provides online support via our web site at www.microchip.com. This web site is used as a means to make files and information easily available to customers. Accessible by using your favorite Internet browser, the web site contains the following information:

- **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

DEVELOPMENT SYSTEMS CUSTOMER CHANGE NOTIFICATION SERVICE

Microchip's customer notification service helps keep customers current on Microchip products. Subscribers will receive e-mail notification whenever there are changes, updates, revisions or errata related to a specified product family or development tool of interest.

To register, access the Microchip web site at www.microchip.com, click on Customer Change Notification and follow the registration instructions.

The Development Systems product group categories are:

- **Compilers** – The latest information on Microchip C compilers, assemblers, linkers and other language tools. These include all MPLAB C compilers; all MPLAB assemblers (including MPASM™ assembler); all MPLAB linkers (including MPLINK™ object linker); and all MPLAB librarians (including MPLIB™ object librarian).
- **Emulators** – The latest information on Microchip in-circuit emulators.This includes the MPLAB REAL ICE™ and MPLAB ICE 2000 in-circuit emulators.
- **In-Circuit Debuggers** – The latest information on the Microchip in-circuit debuggers. This includes MPLAB ICD 3 in-circuit debuggers and PICkit™ 3 debug express.
- **MPLAB® IDE** – The latest information on Microchip MPLAB IDE, the Windows® Integrated Development Environment for development systems tools. This list is focused on the MPLAB IDE, MPLAB IDE Project Manager, MPLAB Editor and MPLAB SIM simulator, as well as general editing and debugging features.
- **Programmers** – The latest information on Microchip programmers. These include production programmers such as MPLAB REAL ICE in-circuit emulator, MPLAB ICD 3 in-circuit debugger and MPLAB PM3 device programmers. Also included are nonproduction development programmers such as PICSTART® Plus and PICkit 2 and 3.

CUSTOMER SUPPORT

Users of Microchip products can receive assistance through several channels:

- Distributor or Representative
- Local Sales Office
- Field Application Engineer (FAE)
- Technical Support

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://www.microchip.com/support.

REVISION HISTORY

Revision A (July, 2013)

Initial release of this document.

NOTES:

Chapter 1. Overview

1.1 INTRODUCTION

Microchip lighting solutions provide opportunities to create product differentiation via customizable user interfaces and the ability to enhance the user's experience. Enhanced capabilities can be integrated into the luminaire ballast/driver, wall controller, or remotes – and are only limited by the developer's creativity.

The Lighting Communications Development Platform provides a universal lighting development platform for the creation of communications-enabled lighting applications. The platform consists of a main board and various communications interface adapters to support in the development of DALI, DMX512A, as well as future protocols.

To utilize the communications platform, a minimum of two main or two prototyping boards and two adapters are required – connected via appropriate cabling (e.g., RJ45 patch cable, DMX512A 5-pin XLR cable, or DALI 2-wire).

The Lighting Communications Development Platform consists of:

- Main communications board
- Prototyping board
- Communications interface adapters:
  - DALI
  - DMX512A

The following are required:

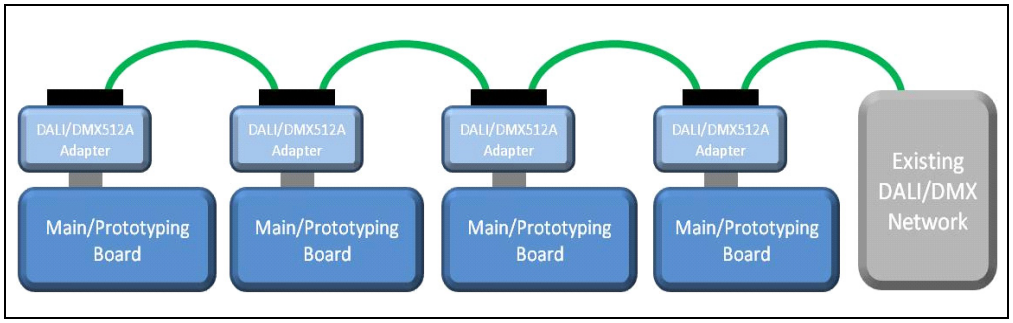
- Minimum of two main or two prototyping boards
- Minimum two adapters connected via appropriate cabling:
  - RJ45 patch cable
  - DMX512A 5-pin XLR cable
  - DALI 2-wire

The communication platform is compatible with commercially-available DALI/DMX512A products and can be integrated into the existing lighting networks during development or utilized with multiple communication platforms to simulate large lighting networks.

To further ease in development, code libraries for both DMX512A and DALI are available as a free download. Go to www.microchip.com/lightingcomms to get started.

Learn more about Intelligent Lighting and Control Solutions from Microchip at www.microchip.com/lighting.

FIGURE 1-1: EXAMPLE CONFIGURATION



1.2 MAIN COMMUNICATION BOARD HIGHLIGHTS

1.2.1 DM160214

- Populated with a PIC16F1947 for user interface, communications and LED control:
  - 4-channel constant current control with RGBW color mixing and dimming
  - Slider potentiometer for dimming control
  - Universal Communications Adapter Interface: DALI, DMX512A and future support
  - Master and slave support for DALI and DMX512A
  - DALI commissioning and support for custom zones and scenes
  - LCD display and push-button user interface
  - Customizable capabilities
- Populated with a MCP6004 op amp for current feedback
- Populated with a MCP16322 for 5V power conversion
- Populated with Cree XLamp MC-E color delivering red, green, royal-blue and white in a single LED – high lumen output in a small form factor
- Populated with the LEDnLIGHT collimator LLC19N optic and holder by Gaggione for high-quality color mixing and tight beam control.
- 9-12V power supply input

1.3 PROTOTYPING COMMUNICATION BOARD HIGHLIGHTS

1.3.1 AC160214

- Populated with a PIC16F1947 for user interface and communications:
  - Universal Communications Adapter Interface: DALI, DMX512A and future support
  - Master and slave support for both DALI and DMX512A
  - DALI commissioning and support for custom zones and scenes
  - Customizable capabilities
- Populated with a MCP16322 for 5V power conversion
- Bread boarding space for customized lighting development
- 9-12V power supply input

1.4 DALI ADAPTER HIGHLIGHTS

1.4.1 AC160214-1

- Screw terminals and RJ45 connectors
- Isolated DALI interface
- Current-limited DALI power supply (jumper option)
- Free DALI 'C' Library
- Demonstration code
- All code resides within the PIC16F1947 on main/prototype board

1.5 DMX512A ADAPTER HIGHLIGHTS

1.5.1 AC160214-2

- XLR5 and RJ45 connectors
- Isolated transceiver
- Bidirectional communication termination (jumper option)
- Free DMX512A 'C' Library
- Demonstration code
- All code resides within the PIC16F1947 on main/prototype board

1.6 DALI STARTER KIT

1.6.1 DV160214-1

- Two main boards
- One prototyping board
- Two DALI adapters
- 9V international power supply
- RJ45 patch cable

1.7 DMX512A STARTER KIT

1.7.1 DV160214-2

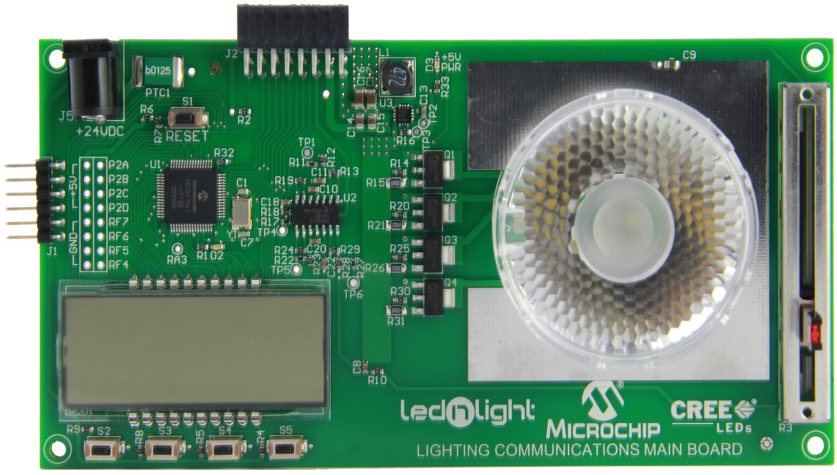
- Two main boards
- One prototyping board
- Two DMX512A adapters
- 9V international power supply
- RJ45 patch cable

NOTES:

Chapter 2. Main Board (DM160214)

The lighting communications main board is the core of the Lighting Communications Development Platform. It uses a PIC16F1947 microcontroller to run the user interface, LCD control, 4-color LED drive and the various communications protocols (see Figure 2-1). By changing the firmware and plug on the adapter, a number of lighting communication protocols can be implemented, such as DMX512A and DALI. Please reference the chapter of the specific protocol adapter for detailed setup.

FIGURE 2-1: LIGHTING COMMUNICATIONS MAIN BOARD



2.1 FEATURES

- PIC16F1947 microcontroller
- Cree XLamp MC-E color LED
- Gaggione Led-n-light 40 mm color-mixing optic
- Analog drive of LEDs
- 6-digit, 7-segment LCD display
- Four switches for input
- Slider potentiometer
- 5V Buck power supply (9 to 24V DC input)
- PICkit™ programming port
- Lighting Communications adapter port
- Eight I/O pins brought to pads

FIGURE 2-2: MAIN BOARD SCHEMATICS: MICROCONTROLLER, LCD AND CONNECTORS

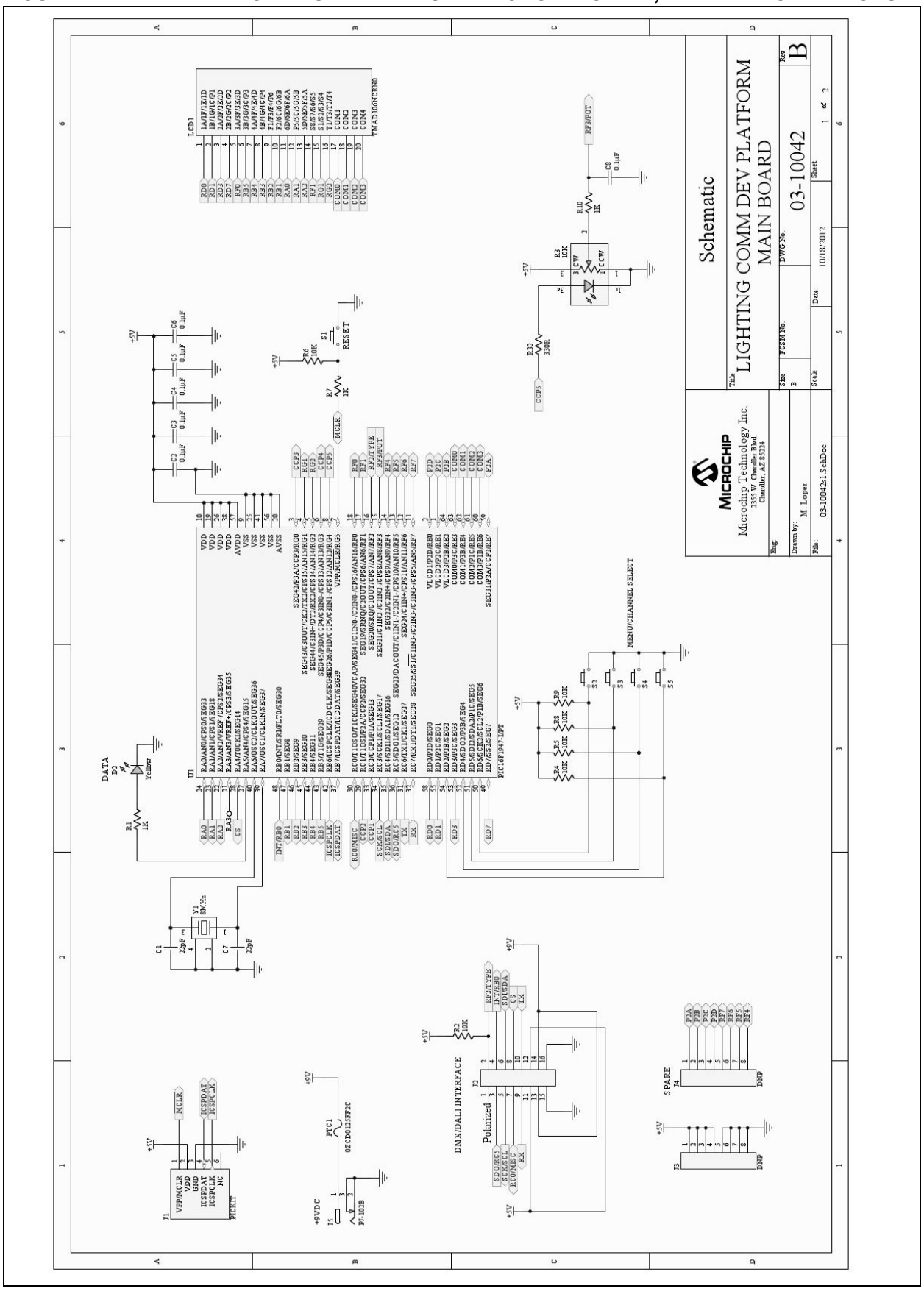
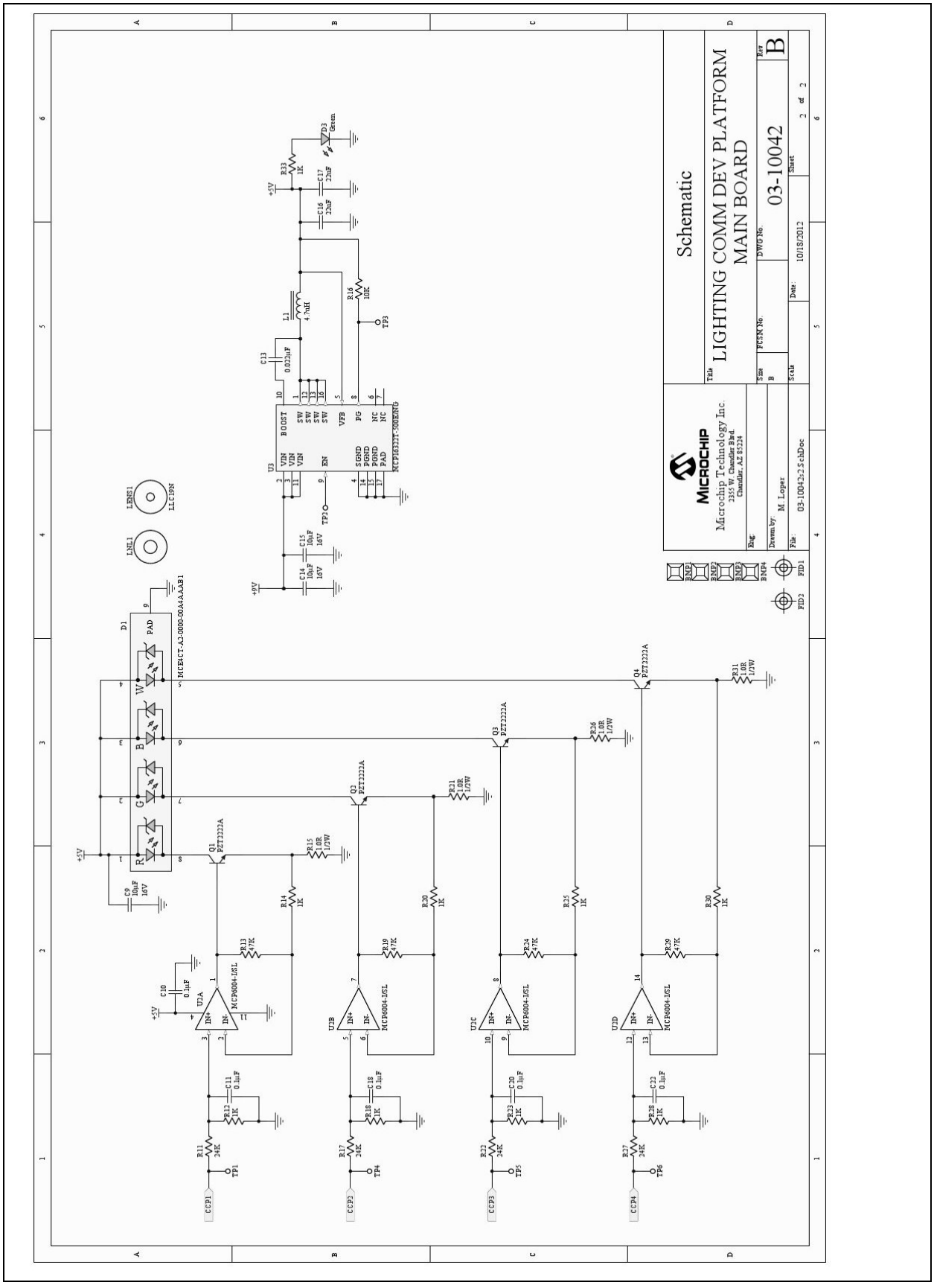


FIGURE 2-3: MAIN BOARD SCHEMATICS: LED DRIVE AND POWER SUPPLY



2.2 STAND-ALONE DEMONSTRATION

FIGURE 2-4: MAIN BOARD STAND-ALONE DEMO

Demonstration Overview

- Self-contained demonstration **without** communications control
- Main communication board performing RGBW (red, green, blue, white) color mix
- PIC16F1947 Controlled Features:
  - RGBW LED color mixing via constant current control
  - Slider and button interface
  - LCD drive and control

Hardware Requirements

- Main communication board
- 9-12V power supply
- PICkit 3 programmer

Firmware Requirements

- *StandAloneDemo.X.production.hex*

Downloadable at www.microchip.com/lightingcomms.

2.2.1 DEMONSTRATION SETUP

1	Utilize the PICkit™ 3 to program the main communication board with stand-alone demonstration code.	
2	Connect the power by inserting the 9V power supply into the DC connector on the controller board.	

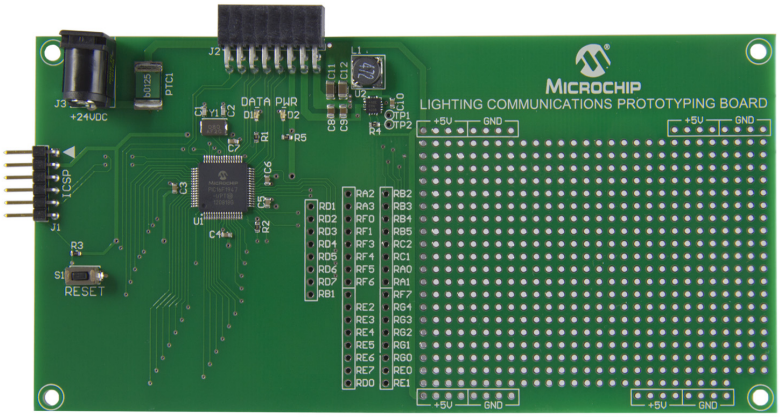
2.2.2 DEMONSTRATION OPERATION MODES

Button 1 (S2) – 'rGb' LCD Display (Power-up mode) • Auto-rotates through red, green, blue, white and custom-color mix • Slider not used	
Button 2 (S3) – 'FAdE' LCD Display • Auto-rotates through red, green, blue, white and custom-color mix with transition fade • Slider not used	
Button 3 (S4) – 'SLId' LCD Display • Slider-controlled rotation through red, green, blue, white and custom-color mix	
Button 4 (S5) – 'LItE' LCD Display • Red, green, blue, white simultaneously 'ON' • Slider-controlled simultaneous dimming of red, green, blue, white	

Chapter 3. Prototyping Board (AC160214)

The lighting communications prototyping board allows for quick prototyping using the communications adapters. It uses a PIC16F1947 microcontroller with the same connections to the adapter boards and breaks out the remaining I/O pins for prototyping your own circuits (see Figure 3-1). Because of the same connections to the adapter boards, the lighting communications libraries are easily adapted to your specific prototype project. For example, a 4-channel lighting console can be built by soldering sliders on to the prototyping area and connecting them to the analog input pins. Please refer to Figure 3-2 for details on I/O pin connections.

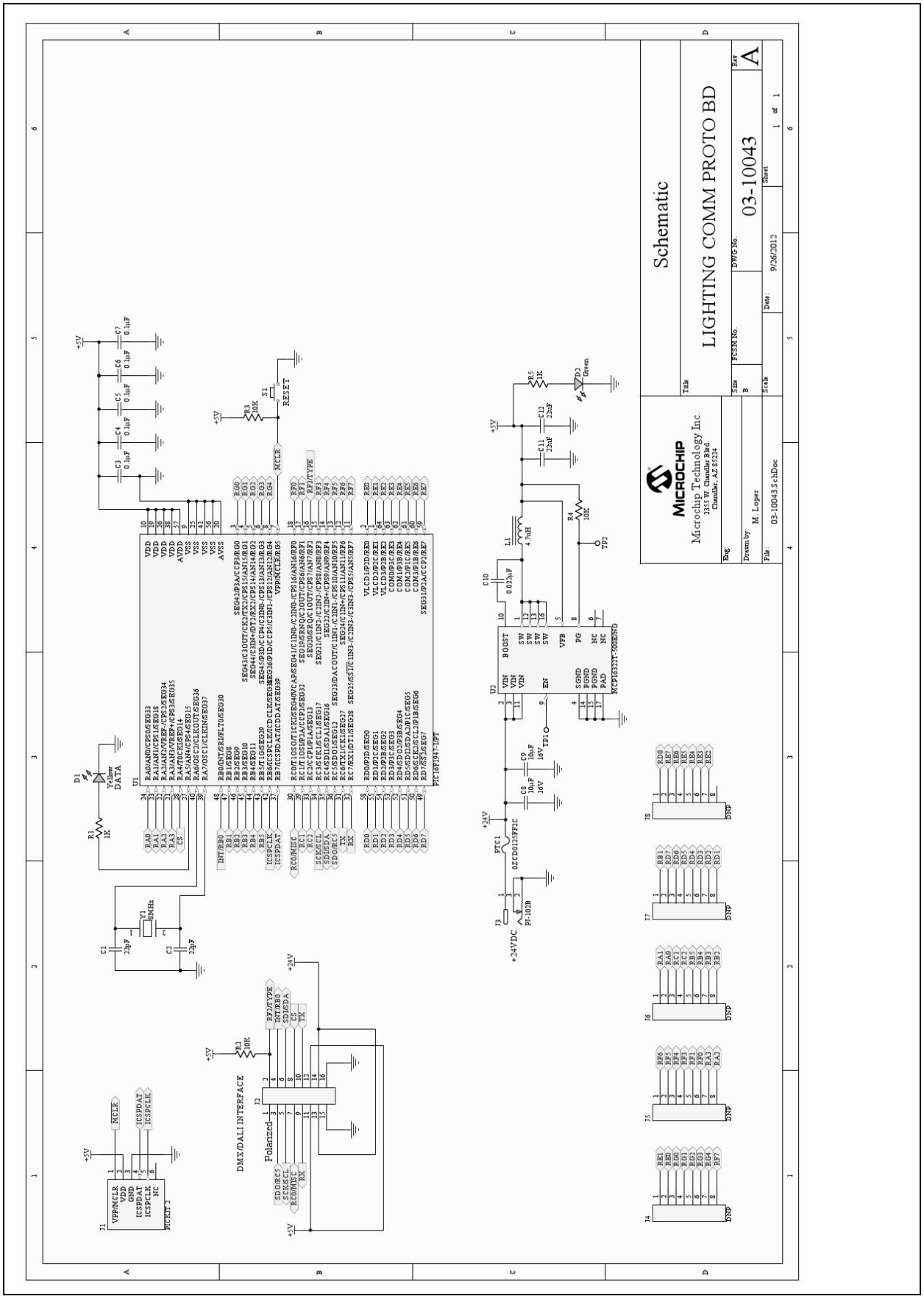
FIGURE 3-1: PROTOTYPE BOARD



3.1 FEATURES

- PIC16F1947 microcontroller
- 5V Buck power supply (9 to 24V DC input)
- PICkit™ programming port
- Lighting Communications adapter port
- Remaining I/O pins brought to pads

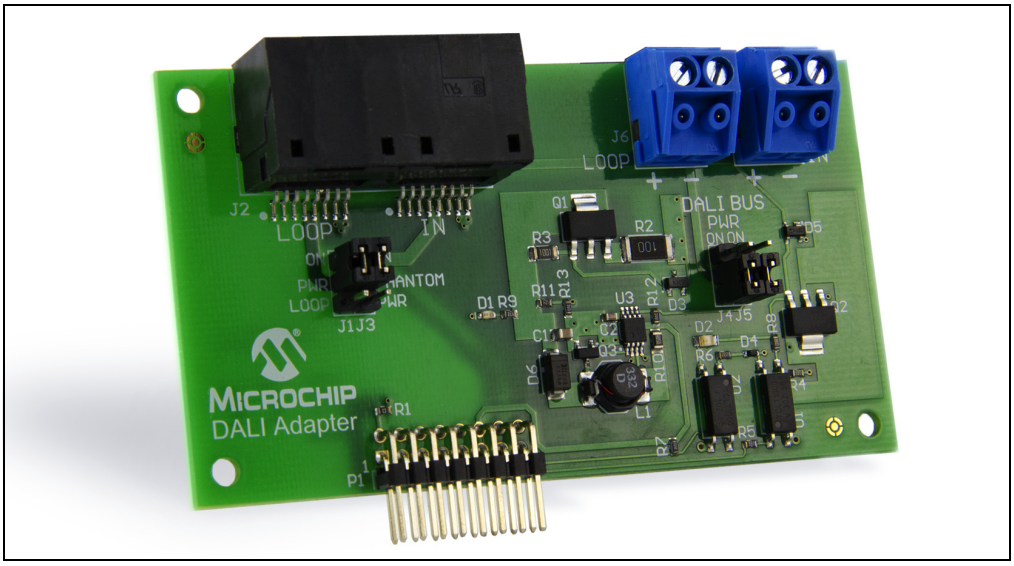
FIGURE 3-2: PROTOTYPE BOARD SCHEMATIC



Chapter 4. DALI Adapter (AC160214-1)

The DALI adapter enables the lighting communications main board to operate as DALI control gear (receiver) or DALI control device (controller). It has screw terminals for basic DALI connection, and RJ45 connectors for quick connect of multiple DALI adapter boards together. It has a boost power supply with a simple high-speed current limit circuit to act as a DALI power supply. The option of phantom power is included on the RJ45 connector to allow multiple development boards to be powered from a single supply (see Figure 4-1).

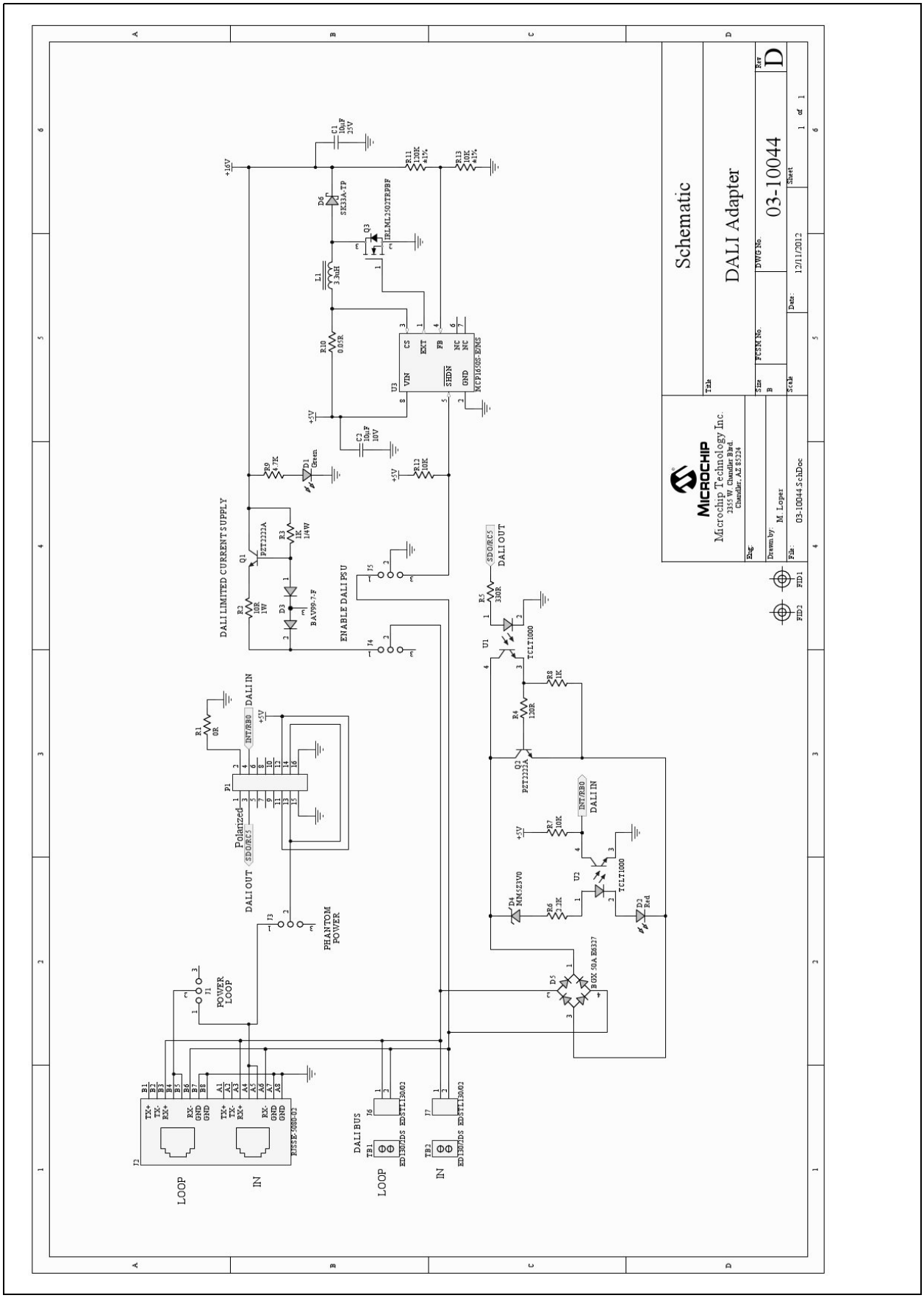
FIGURE 4-1: DALI ADAPTER BOARD



4.1 FEATURES

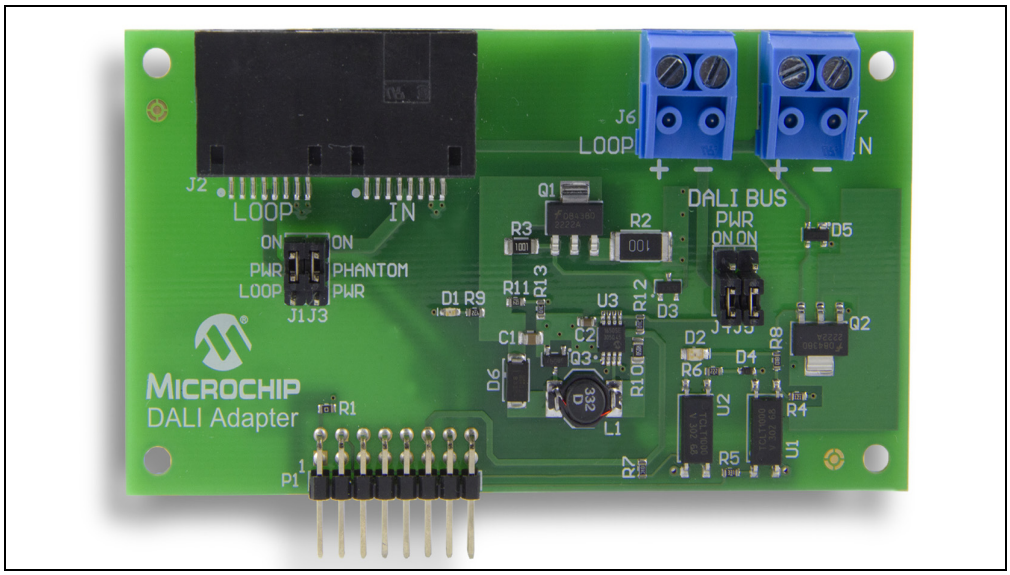
- Two screw terminal blocks for general purpose DALI connectivity
- RJ45 connectors for quick connection of multiple boards
- Optically-isolated DALI bus for safety
- Built-in 16V current-limited DALI power supply required for DALI communications
- Power shared across RJ45 connector so that multiple boards can be powered from a single supply.

FIGURE 4-2: DALI ADAPTER SCHEMATIC



4.2 BOARD SETTINGS

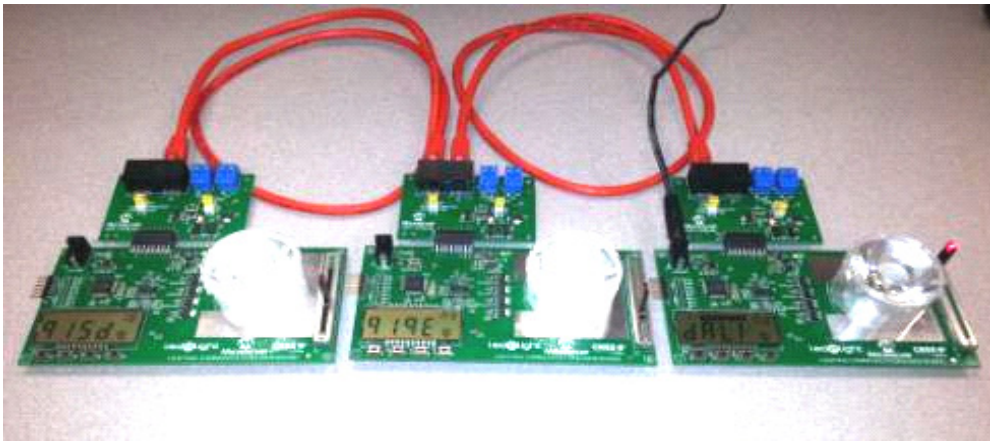
FIGURE 4-3: DALI ADAPTER JUMPERS



Label	Name	Description	Settings
J1	Loop	Loops phantom power to next board.	ON = Loop power to next board OFF = Do not loop power
J3	Phantom Power	It enables phantom power to supply or be supplied from the main board.	ON = Phantom power enabled OFF = Phantom power disabled
J4, J5	PWR	DALI Power supply. Enabling this connects the boost and current-limiting power supply to the DALI bus. **NOTE**: Enabling this removes the electrical isolation.	Both ON = DALI Power enabled and connected to the bus Both OFF = DALI Power disabled
J6	Loop	Screw terminal for general purpose DALI connection. Use this one to loop the DALI bus.	
J7	In	Screw terminal for general purpose DALI connection. Use this as the DALI bus input.	
J2	Loop/In	RJ45 connectors for DALI input, output and loop. It also allows phantom power for easy connection of demo boards. Phantom power is not a DALI standard – this capability is provided for ease of use during development. The RJ45 connector is for quick connection of the demo boards only and should not be used in end products as it does not comply with the DALI electrical requirements.	
P1		Connection to the main board.	

4.3 DALI DEMONSTRATION

FIGURE 4-4: DALI DEMONSTRATION CONFIGURATION



Demonstration Overview

- DALI bidirectional communications control
- Single-control device sending commands to multiple control gears
- Control gear performing white dimming based on control device commands
- PIC16F1947 Controlled Features:
  - White LED dimming via constant current control
  - Slider and button interface
  - LCD drive and control
  - DALI command and control

Hardware Requirements

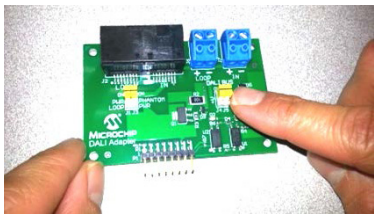
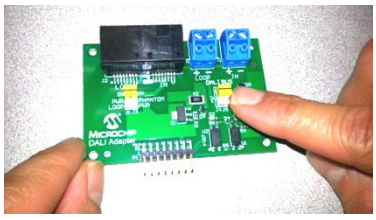
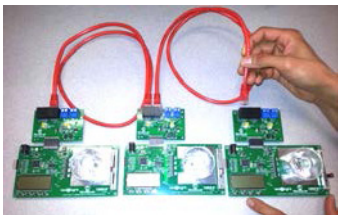
- Three main communication boards
- Three DALI adapters
- Two RJ45 patch cables:
  - Optional: two 2-wire cables
- 9-12V power supply
- PICkit 3 programmer

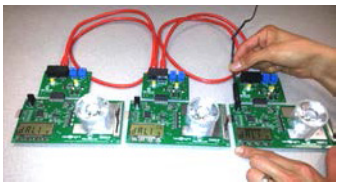
Firmware Requirements

- Control device demonstration code: *DALI_ControlDeviceDemo.hex*
- Control gear demonstration code: *DALI_ControlGearDemo.hex*

Downloadable at www.microchip.com/lightingcomms.

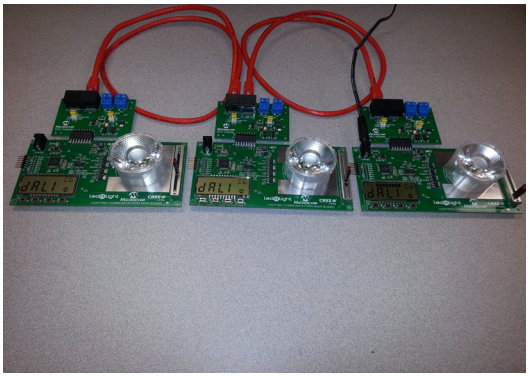
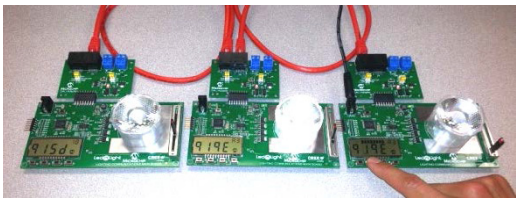
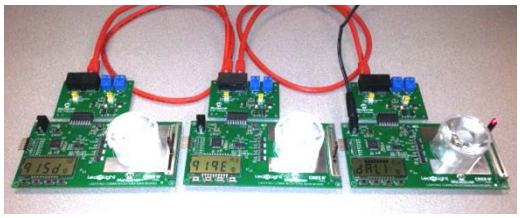
4.3.1 Demonstration Setup

1	Utilize the PICkit™ 3 to program the main communication board with control device demonstration code.	
2	Utilize the PICkit 3 to program one or more additional boards with the control gear demonstration code.	
3	Set up the DALI adapter board as power supply. Use the following settings: J1 = ON J3 = ON J4 and J5 = ON	
4	Set up the remaining DALI adapter boards. Use the following jumper settings: J1 = ON J3 = ON J4 and J5 = OFF	
5	Connect the DALI boards to the main boards.	
6	Connect the demo boards together using the RJ45 connectors and Ethernet patch cables.	

7	Connect the 9-12 VDC power cord to one of the boards.	

4.3.2 Demonstration Operation

4.3.2.1 CONTROL DEVICE

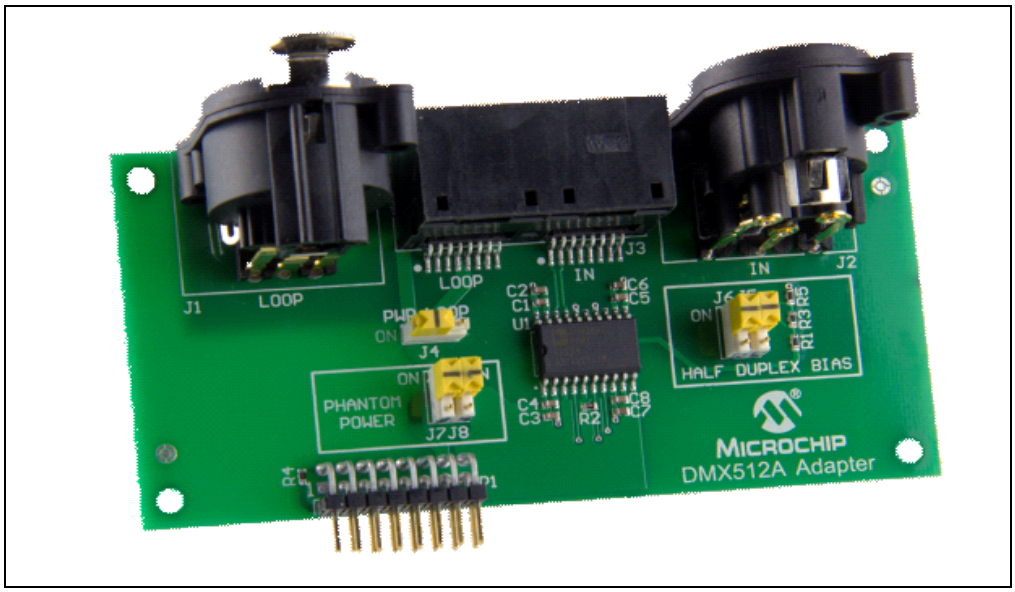
	LCD displays "Cd" in the top right corner for the Control Device firmware, and "CG" for the control gear firmware. Main display will be "dALI". Button **S2** of the control device initiates the commissioning sequence. Buttons **S3** to **S5**: 1. During commissioning, these assign the short address to the currently highlighted control gear. 2. During normal operation, these toggle the selected control gear ON and OFF. Slider is used in Normal mode to set the level of the last selected control gear. Note that the LED on the control device is not active.	
	How to run a commissioning sequence: 1. Power-up the boards 2. Press **S2** to start the sequence. The display will start scrolling through a 24-bit hex search sequence. 3. When a control gear is discovered, the count will stop and its LED will go bright. 4. Select a button (**S3** to **S5**) to associate this control gear with. Once assigned, the LED will dim down and the count will continue. 5. This repeats until all devices have been discovered and the count runs out.	Start Commission  Assigning the control gear to a switch 
	Controlling the lights: 1. Press a button, **S3** to **S5**, to turn the selected control gear ON and OFF. 2. Once a control gear is selected, then the slider can be used to set its brightness.	Running the demo 

NOTES:

Chapter 5. DMX512A Adapter (AC160214-2)

The DMX512A adapter enables the lighting communications main board to operate as a DMX512A controller or receiver. It has the DMX512A standard 5-pin XLR connectors for connection to existing equipment, and RJ45 connectors for quickly connecting multiple adapter boards together (see Figure 5-1). Using an isolated RS-485, it complies with the DMX512A standard. We have added the option of phantom power which allows multiple development boards to be powered from a single supply. This breaks the isolation and is not part of the DMX512A standard.

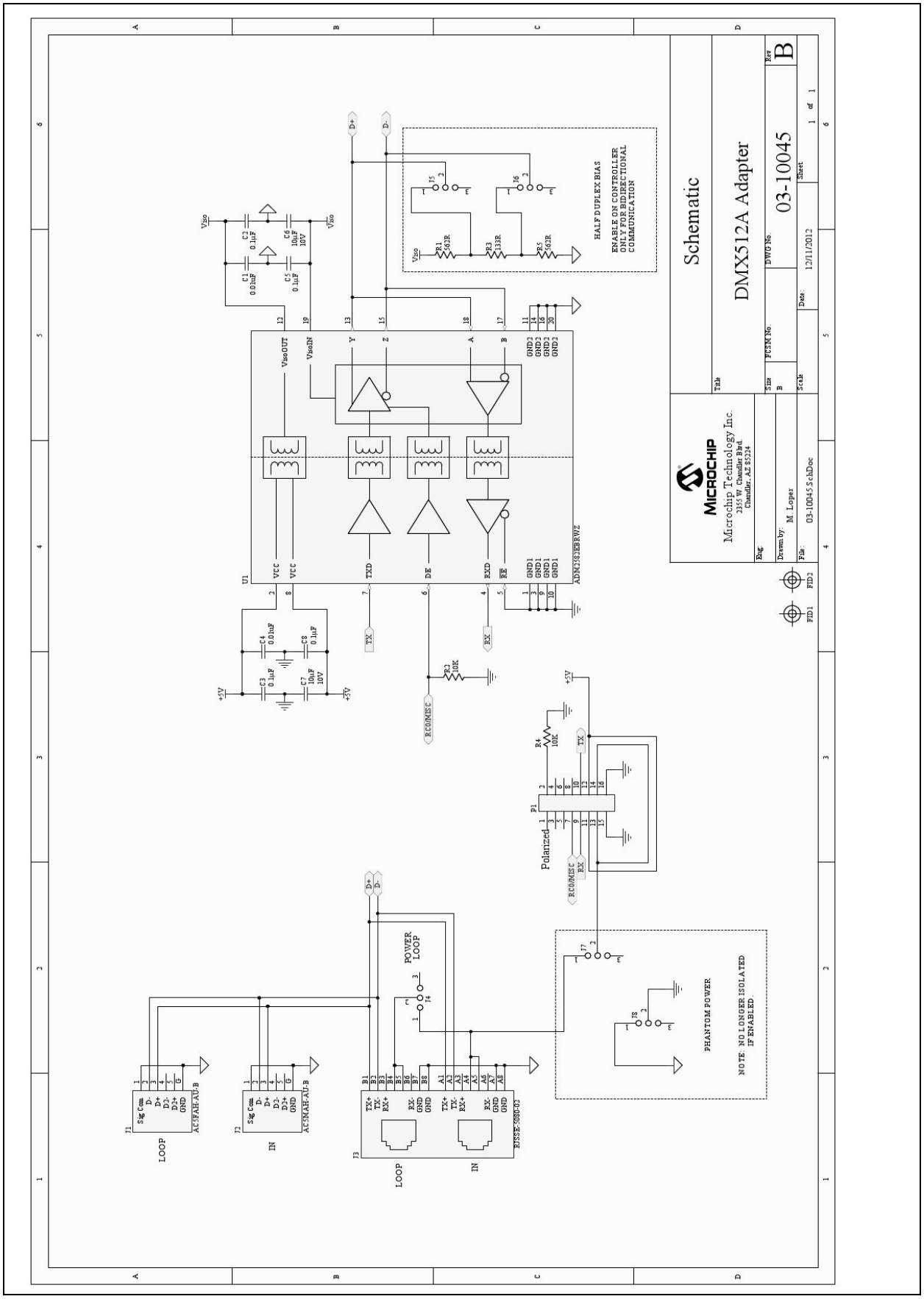
FIGURE 5-1: DMX512A ADAPTER



5.1 FEATURES

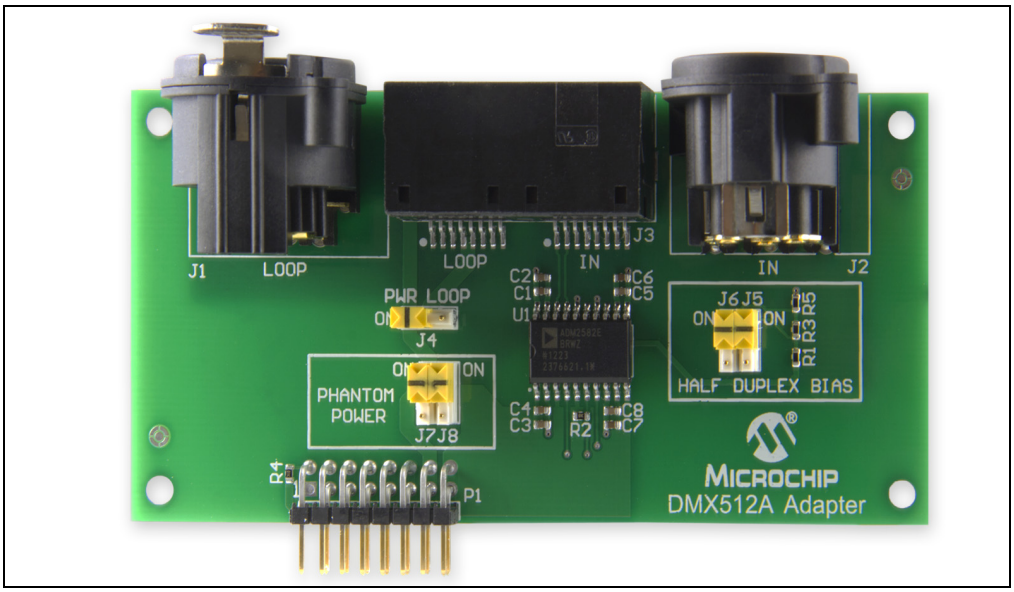
- 5-pin XLR plug and socket (DMX512A compliant)
- Isolated RS-485 transceiver (DMX512A compliant)
- RJ45 connectors for quick connection of multiple boards wired to DMX512A pinouts
- Power shared across RJ45 connector so that multiple boards can be powered from a single supply (Removes isolation and is not DMX512 compliant. For experimentation only)
- Half-duplex biasing for half-duplex operation as controller (removes isolation)
- Lighting communications adapter connector

FIGURE 5-2: DMX512A ADAPTER SCHEMATIC



5.2 BOARD SETTINGS

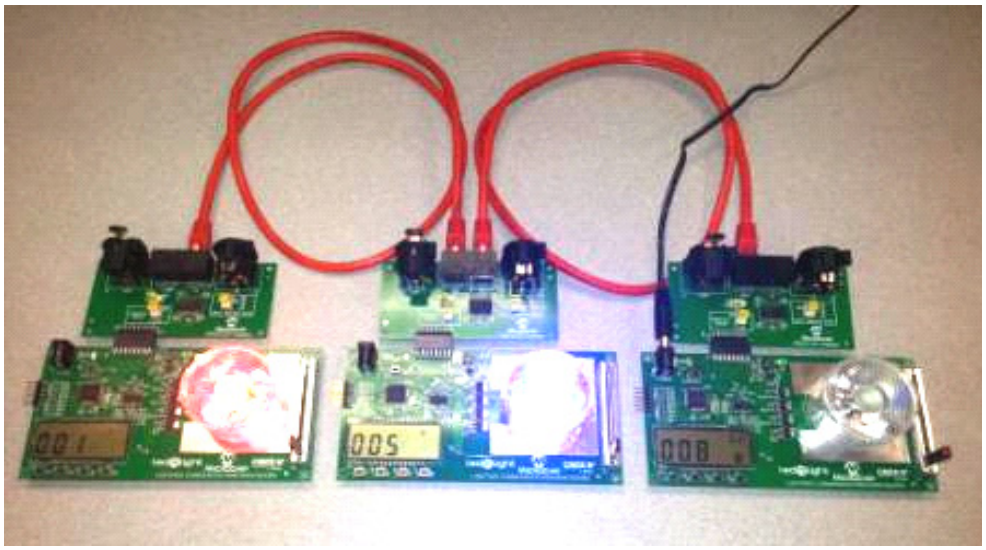
FIGURE 5-3: DMX512A ADAPTER JUMPERS



Label	Name	Description	Settings
J4	PWR Loop	Loops phantom power to next board.	ON = Loop power to next board OFF = Do not loop power
J7, J8	Phantom Power	It enables phantom power to supply or be supplied from the main board. Using this option, it removes the isolation so is no longer DMX512A compliant.	Both ON = Phantom power enabled Both OFF = Phantom power disabled
J5, J6	Half-Duplex Bias	It enables the half-duplex bias resistors needed for bidirectional communication used by DMX512A for RDM and other enhanced functions.	Both ON = Bias enabled Both OFF = Bias disabled
J1	Loop	5-pin XLR socket for DMX512A out or looping to the next board.	
J2	In	5-pin XLR socket for DMX512A input.	
J3	Loop/In	RJ45 connectors for DMX512A input, output and loop. Wired according to the DMX512A RJ45 connection standard for permanent wiring. It also allows the phantom power using the “unused” wires for easy connection of demo boards which is not DMX512A compliant.	
P1		Connection to the main board.	

5.3 DMX512A DEMONSTRATION

FIGURE 5-4: DMX512A DEMONSTRATION CONFIGURATION



Demonstration Overview

- DMX512A unidirectional communications control
- Single controller sending commands to multiple receivers
- Receivers performing RGBW (red, green, blue, white) color mix based on controller commands
- PIC16F1947 Controlled Features:
  - RGBW LED color mixing via constant current control
  - Slider and button interface
  - LCD drive and control
  - DMX512A command and control

Hardware Requirements

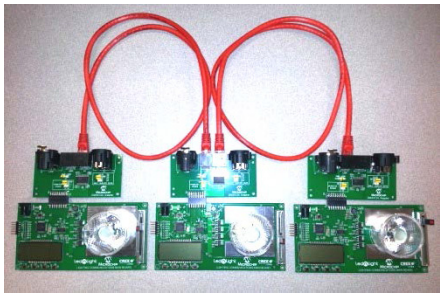
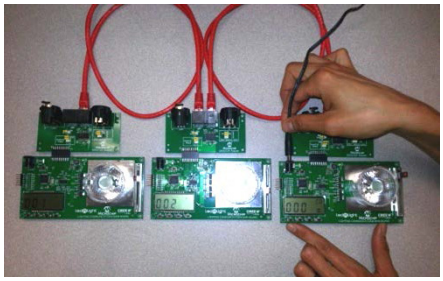
- Three main communication boards
- Three DMX512A adapters
- Two RJ45 patch cables:
  - Optional: Two XLR5 cables
- 9-12V power supply
- PICkit 3 programmer

Firmware Requirements

- Controller demonstration code: *DMX512A_ControllerDemo.hex*
- Receiver demonstration code: *DMX512A_ReceiverDemo.hex*

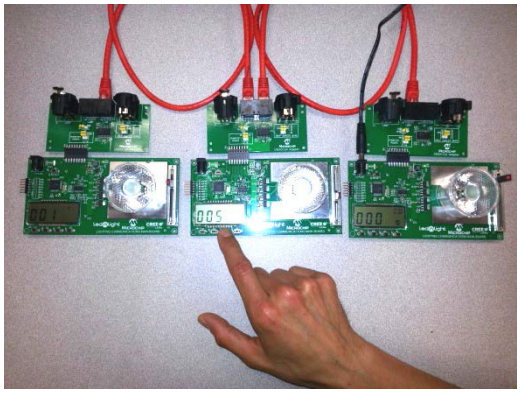
Downloadable at www.microchip.com/lightingcomms.

5.3.1 Demonstration Setup

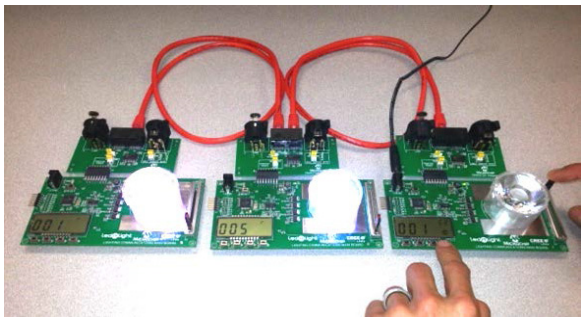
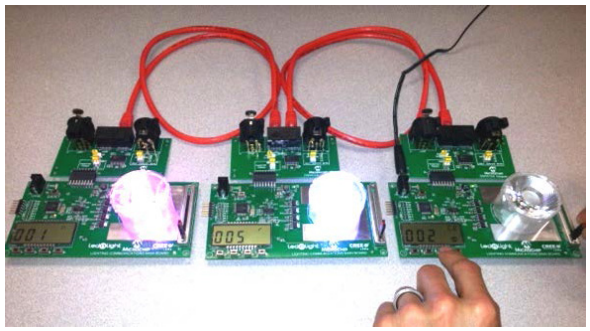
1	Utilize the PICkit™ 3 to program the main communication board with controller demonstration code.	
2	Utilize the PICkit 3 to program one or more additional boards with the DMX512A receiver demonstration code.	
3	Set up the adapter jumper settings, then plug the adapter onto the main boards. Use the following settings: • J4 – ON • J5 – ON • J6 – ON • J7 – ON • J8 – ON	
4	Use RJ45 cables to connect the controller to the receivers by daisy-chaining the cables between them as shown.	
5	Connect the power by inserting the 9V power supply into the DC connector on the controller board.	

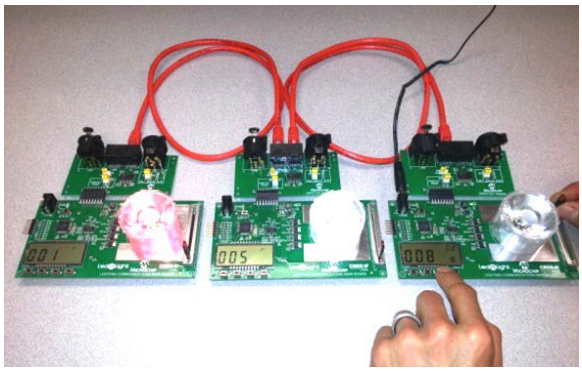
5.3.2 Demonstration Operation

5.3.2.1 RECEIVER

	LCD displays an '`r`' in the top right corner for the receiver firmware. A 3-digit DMX512A base address will also be displayed on the LCD. Buttons **S2** to **S4** set the base address of the receiver. Each board uses four addresses, one for each color in the order of red, green, blue and white.	
	Set the base address of each receiver to a unique or common address in the range 1 to 512. For the generic demo, please set one of the receiver boards to address '`001`'. If you have more than one receiver board, add 4 to each board address to get the correct offset. (e.g., `001 005 009 013 017 021`, etc.)	

5.3.2.2 CONTROLLER

	A 'C' is displayed on the top right of the LCD, followed by a single digit to show what mode the demo is in. The transmit address is also displayed on the LCD. Use button **S4** to rotate through the modes C0 to C2. Buttons **S2**, **S3** and **S4** are used to set the DMX transmit address for mode C2. Note that the LED on the controller is not active.	
	Mode C0: This is the OFF mode, transmission should cease.	
	Mode C1: It automatically rotates between red, green, blue, white and some color mixes. No interaction with slider or buttons.	

	Mode C2: It manually sets the selected address using the slider value. Change the address using buttons **S2**, **S3** and **S4**. Adjust the slider to set the level of that channel. Change the address to the next channel that you want to change and move the slider accordingly. **Note**: Channels will be automatically updated to the current slider value as you rotate through the addresses. Example: • Set controller address display to '001'. Slider controls the red LED of receiver '001'. • Set controller address display to '002'. Slider controls the green LED of receiver '001'. • Set controller address display to '008'. Slider controls the white LED of receiver '005'.	

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