UM10563

Gaming suitcase demo system

Rev. 1 — 9 August 2012 **User manual**

Document information

Info	Content
Keywords	I2C-bus, I2C, PCU9669, bus controllers, LED driver, stepper motor, Fast-mode Plus, Fm+, Ultra Fast-mode, UFm
Abstract	The ‘Gaming suitcase’ is a demonstration system for I^2C-bus controllers, LED drivers, and stepper motor controllers. This demo system enables quick and easy evaluation of the PCU9669, PCU9655, PCU9955 and PCA9629.

Revision history

Rev	Date	Description
v.1	20120809	user manual; initial release

Contact information

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1. Introduction

The ‘Gaming suitcase demo system’ is a demonstration kit for I^{2}C-bus controllers, LED drivers and stepper motors. This demonstration kit and software provide an overview of the capabilities of its components and is easy to use.

The PCU9669 is a new generation I^{2}C-bus controller that supports new ‘Ultra Fast-mode (UFm)’ which is defined in latest I^{2}C-bus specification (Ref. 1). The PCU9669 bridges MCU’s parallel bus and 3 channel I^{2}C buses (UFm $\times$ 2 channels + Fm+ $\times$ 1 channel). The PCU9669 (and its family) has a large buffer to manage transfers with ultra low CPU load.

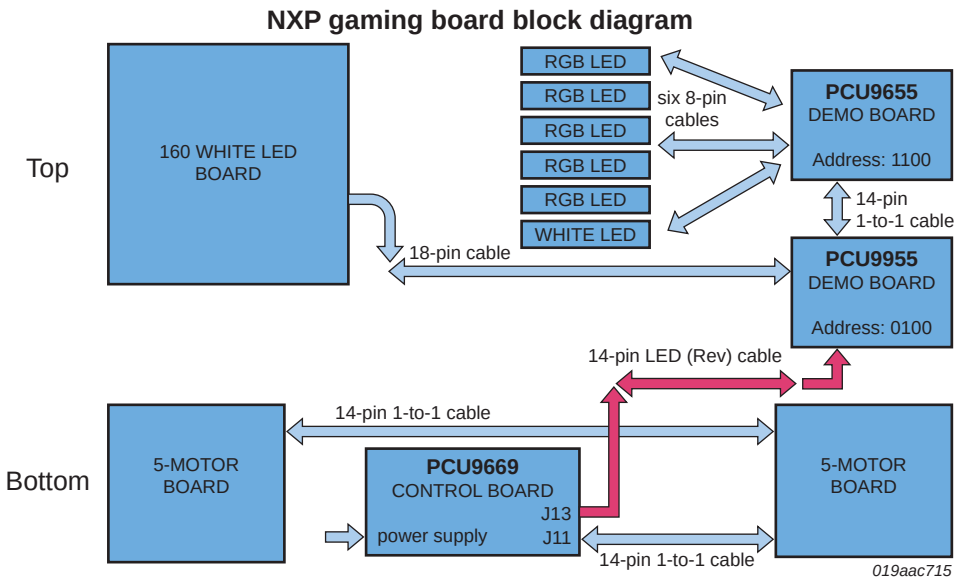
The PCU9955 is a constant current LED driver.

The PCU9655 is a voltage switch LED driver.

Sample code is available for the demo kit. The processor is an NXP LPC2214 ARM microcontroller. The LPC12214 supports to build a feature-rich demo with its high capability.

This evaluation board kit is populated with the following:

- PCU9669 motherboard with ARM7 LPC2214 microcontroller
- One 160-white-LED board (PCA9955)
- Six 4-RGB-LED boards (PCU9655)
- One 8-white-LED board (PCU9655)
- Two 5-stepper motor boards (PCA9629)
- Universal power supply



(1) Channel 0 (J11) of PCU9669 is an Fm+ channel. Normal I^{2}C-bus devices can be connected on this channel.

(2) Channel 1 (J12) and channel 2 (J13) of PCU9669 are UFm channels and are used for the Ultra-Fast mode LED controllers.

Fig 1. Gaming suitcase block diagram

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2. Features

- A complete demonstration platform for the PCU9669 I^{2}C-bus controller, the PCU9655 and PCU9955 LED drivers, and the PCA9629 stepper motor controller used in gaming and vending machines
- Easy to use pre-programmed demonstrations
- I^{2}C connectors are compatible for I^{2}C-bus slave device demo boards
- Easy software development using Keil or GNU C compilers
- Complete sample code for demo operation
- Field programmable
- Convenient test points for easy scope and logic analyzer measurements

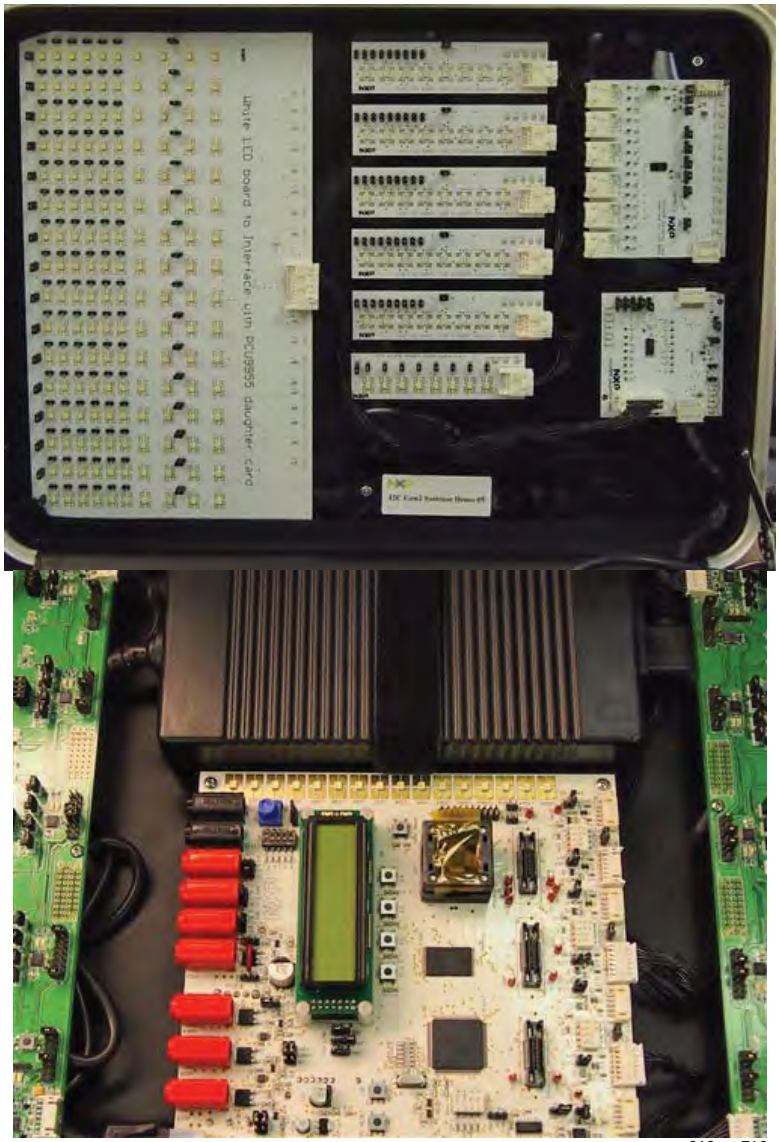

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Fig 2. Gaming suitcase top and bottom panels

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3. Getting started

3.1 Assumptions

Familiarity with the I^2C-bus is helpful but not required.

3.2 Target versions

This user manual is written based on the versions of:

- Sample code — version 1.0

3.3 Static handling requirements

CAUTION

This device is sensitive to ElectroStatic Discharge (ESD). Therefore care should be taken during transport and handling. You must use a ground strap or touch the PC case or other grounded source before unpacking or handling the hardware.

3.4 Ordering

Demo systems are available for loan to qualified users upon request at **i2c.support@nxp.com**.

3.5 Minimum requirements

3.5.1 Stand-alone demo

- A 100 V to 240 V AC power source

3.5.2 Development

- A 100 V to 240 V AC power source
- USB cable with mini-USB connector
- A PC with a C compiler such as Keil
- PCU9669 motherboard
- PCU9955, PCU9655 and PCA9629 demo boards

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3.6 Setup

This section describes how to set up the Gaming suitcase demo.

3.6.1 PCU9669 demo setup

3.6.1.1 Jumper settings

Default jumper and switch positions for the PCU9669 demo.

Table 1. Jumper settings

Jumper	Position	Description
Motherboard		
JP1	open (default)	reserved for microcontroller programming (CBUS1)
	1-2	reserved
JP2	1-2	reserved for microcontroller programming (CPU Rst)
	open (default)	reserved
JP3	open (default)	JTAG TRCK LPC2214 not returned
	1-2	JTAG TRCK LPC2214 returned
JP5	open (default)	JTAG LPC2214 IDC +3.3 V power not connected
	1-2	JTAG 2214 IDC +3.3 V power connected
JP11	open (default)	JTAG TCK PCA966x not returned
	1-2	JTAG TCK 996x returned (pin 9 to 11)
JP12	open (default)	JTAG 996x IDC +3.3 V not connected
	1-2	JTAG 996x IDC +3.3 V power connected
JP13	open	CH0 24 V power not connected
	1-2 (default)	CH0 24V power connected
JP14	open (default)	CH0 test mode SCL0 pull-down disabled
	1-2	CH0 test mode SCL0 pull-down enabled
JP15	open (default)	CH0 test mode SDA0 pull-down disabled
	1-2	CH0 test mode SDA0 pull-down enabled
JP16	1-2 (default)	CH1 24 V power enabled
	open	CH1 24 V power disabled
JP17	open (default)	CH1 test mode SCL1 pull-down disabled
	1-2	CH1 test mode SCL1 pull-down enabled
JP18	open (default)	CH1 test mode SDA1 pull-down disabled
	1-2	CH1 test mode SDA1 pull-down enabled
JP19	1-2 (default)	CH2 24 V power enabled
	open	CH2 24 V power disabled
JP20	open (default)	CH2 test mode SCL2 pull-down disabled
	1-2	CH2 test mode SCL2 pull-down enabled
JP21	open (default)	CH2 test mode SDA2 pull-down disabled
	1-2	CH2 test mode SDA2 pull-down enabled
JP4	1-2	TXD - 2214 enabled
	open (default)	TXD - 2214 disabled

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Table 1. Jumper settings *...continued*

Jumper	Position	Description
JP7	1-2 (default)	LCD_D0 enabled
	2-3	LCD_D0 disabled
JP8	1-2	LCD CMOS TX/RX disabled
	2-3 (default)	LCD CMOS TX/RX enabled
JP9	open (default)	AIN0 pin 3/AIN1 pin 2/GND pin 1 headers — no jumpers
JP10	open (default)	LCD_D1 reserved
	open (default)	LCD_D1 reserved
JP22	1-2 (default)	PCU9955 pwr pin 1 = 5 V selected
	2-3	PCU9955 pwr pin 3 = 3.3 V selected
SV3	1-2 (default)	3.3 V Switched PS enabled
	2-3	3.3 V Switched SV3 supply (banana plug)
SV4	1-2 (default)	3.3 V Master PS enabled
	2-3	3.3 V Master SV4 supply (banana plug)
SV5	1-2 (default)	3.3 V PLL PS enabled
	2-3	3.3 V PLL PS SV5 supply (banana plug)
SV6	1-2 (default)	5 V Switched enabled
	2-3	5 V Switched SV6 supply (banana plug)

Table 2. Switch positions

Switch	Position	Description
SW9	ON	S1: SCL0 pull-up
	ON	S2: SDA0 pull-up
	OFF	S3: SDA0 series resistor
	OFF	S4: SCL0 series resistor
SW10	OFF	S1: SCL1 pull-up
	OFF	S2: SDA1 pull-up
	ON	S3: SDA1 series resistor
	ON	S4: SCL1 series resistor
SW11	OFF	S1: SCL2 pull-up
	OFF	S2: SDA2 pull-up
	ON	S3: SDA2 series resistor
	ON	S4: SCL2 series resistor
SW12	ON	S1: A0 PCU9955
	ON	S2: A1 PCU9955
	ON	S3: A2 PCU9955
	ON	S4: A3 PCU9955
	OFF	S5: $\overline{\text{RESET}}$ PCU9955

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Table 3. 160 white LED board

Jumper	Position	Description
J8, J16, J24, J32, J40, J48, J56, J64, J72, J80, J88, J96, J104, J112, J128, J128	1-2 (default)	24 V power rail on pin 1
	open	V_{LED} power disabled.
J7, J15, J23, J31, J39, J47, J55, J63, J71, J79, J87, J95, J103, J111, J119, J127	1-2 (default)	Shorts four LEDs out of the string due to V_{LED} limit of 24 V.
	open	String of four LEDs enabled.
J1 to J6, J9 to J14, J17 to J22, J25 to J30, J33 to J38, J41 to J46, J49 to J54, J57 to J62, J65 to J70, J73 to J78, J81 to J86, J89 to J94, J97 to J102, J105 to J110, J113 to J118, J121 to J126	open (default)	Corresponding LED enabled.
	1-2	Corresponding LED disabled.

Table 4. PCU9955 demo board

Jumper	Position	Description
J1	1-2 (default)	V_{LED} 24 V
	2-3	V_{LED} 5 V
J3	1-2	PCU9955 PWR 3.3 V
	2-3 (default)	PCU9955 PWR 5 V
J4	1-2 (default)	A3 LOW (V_{SS})
	2-3	A3 HIGH (V_{DD})
J5	1-2 (default)	A2 LOW (V_{SS})
	2-3	A2 HIGH (V_{DD})
J6	1-2	A1 LOW (V_{SS})
	2-3 (default)	A1 HIGH (V_{DD})
J7	1-2 (default)	A0 LOW (V_{SS})
	2-3	A0 HIGH (V_{DD})
J8	open (default)	SCL pull-up disabled
	1-2	SCL pull-up enabled
J9	open (default)	SDA pull-up disabled
	1-2	SDA pull-up enabled
J10	1-2 (default)	Reset HIGH - inactive
	open	Reset LOW - active

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Table 5. PCU9655 demo board

Jumper	Position	Description
J1	1-2	A0 LOW (V_{SS})
	2-3 (default)	A0 HIGH (V_{DD})
J3	1-2	PCU9655 PWR 3.3 V
	2-3 (default)	PCU9655 PWR 5 V
J4	1-2 (default)	A4 LOW (V_{SS})
	2-3	A4 HIGH (V_{DD})
J5	1-2 (default)	A3 LOW (V_{SS})
	2-3	A3 HIGH (V_{DD})
J6	1-2 (default)	A2 LOW (V_{SS})
	2-3	A2 HIGH (V_{DD})
J7	1-2	A1 LOW (V_{SS})
	2-3 (default)	A1 HIGH (V_{DD})
J8	open	SCL pull-up disabled
	1-2	SCL pull-up enabled
J9	open	SDA pull-up disabled
	1-2 (default)	SDA pull-up enabled
J10	1-2 (default)	Reset HIGH - inactive
	2-3	Reset LOW - active
JP9	1-2	V_{LED} 5 V
	2-3 (default)	V_{LED} 24 V

Table 6. Left stepper motor board

Jumper	Position	Description
J7	1-2 and 9-10	Address 40h
J11	1-2 and 15-16	Address 42h
J17	7-8 and 9-10	Address 44h
J23	7-8 and 15-16	Address 46h
J32	1-2 and 13-14	Address 48h

Table 7. Right stepper motor board

Jumper	Position	Description
J7	1-2 and 11-12	Address 4Ah
J11	7-8 and 13-14	Address 4Ch
J17	7-8 and 11-12	Address 4Eh
J23	5-6 and 9-10	Address 50h
J32	3-4 and 9-10	Address 52h

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3.6.1.2 Connections

The following figures are a collection of images that illustrate the connections between the various boards in the demo system.

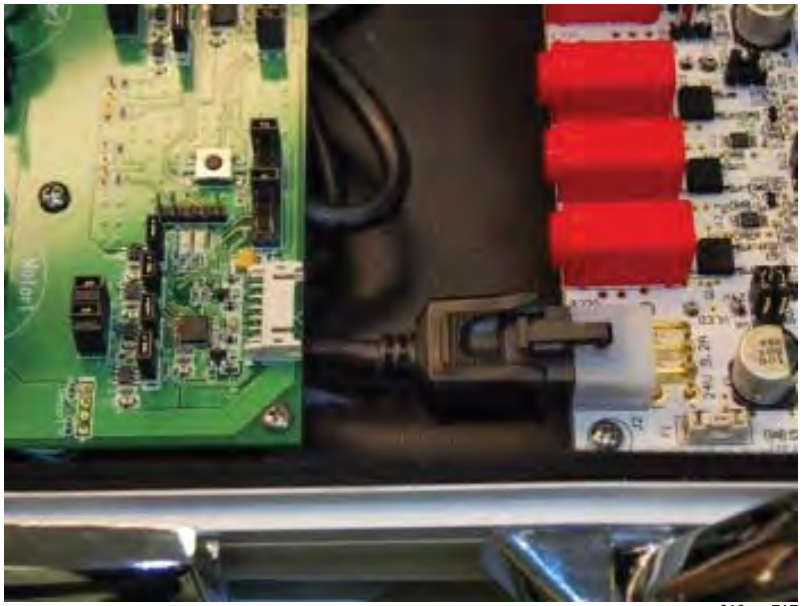

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Fig 3. DC 24 V connector

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Fig 4. Board-to-board connection — stepper motor controllers

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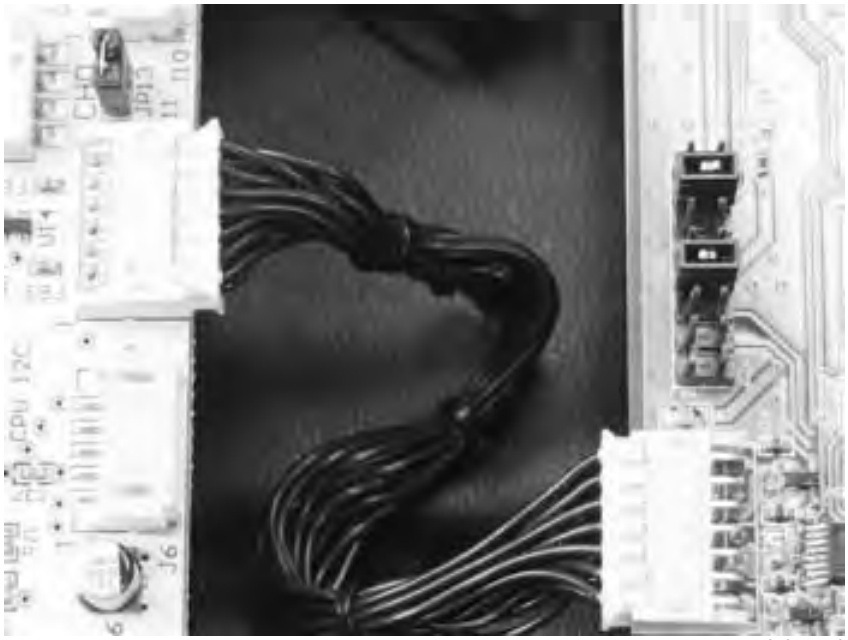

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Fig 5. Motherboard to stepper motor board connection

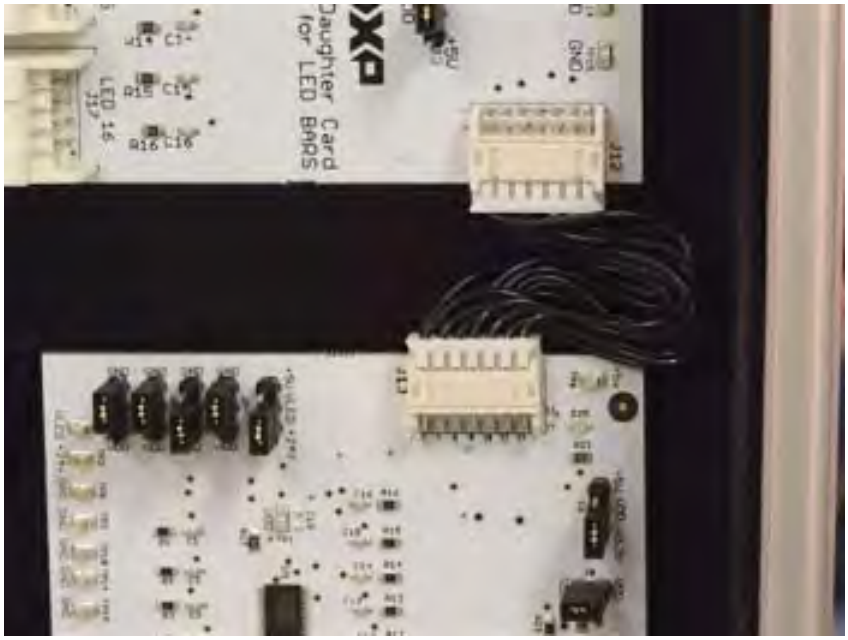

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Fig 6. Board-to-board connection — LED controllers

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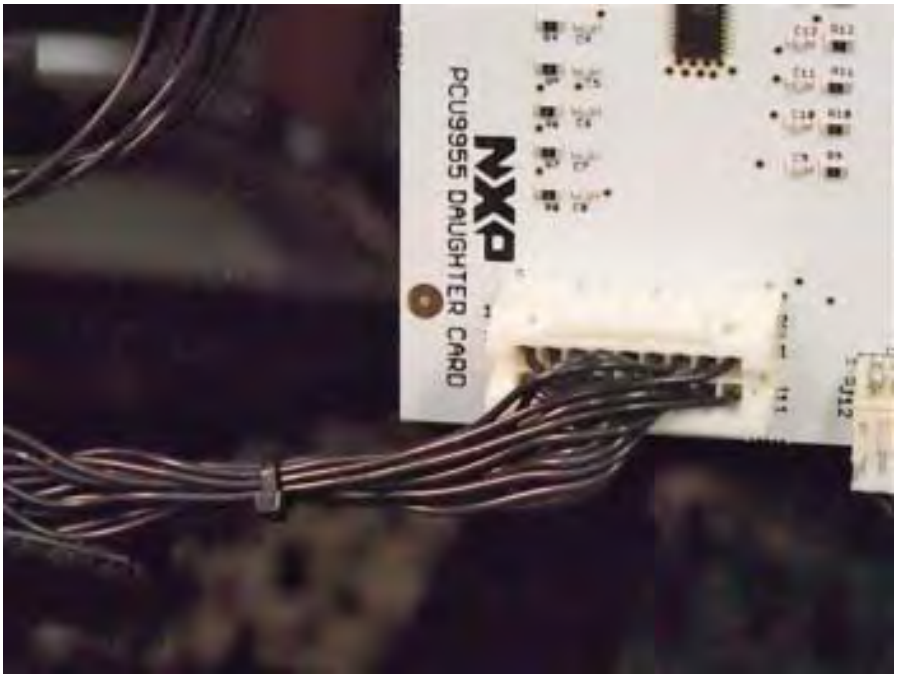

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Fig 7. LED160 18-pin connector on PCU9955 board

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Fig 8. LED160 board 18-pin connector

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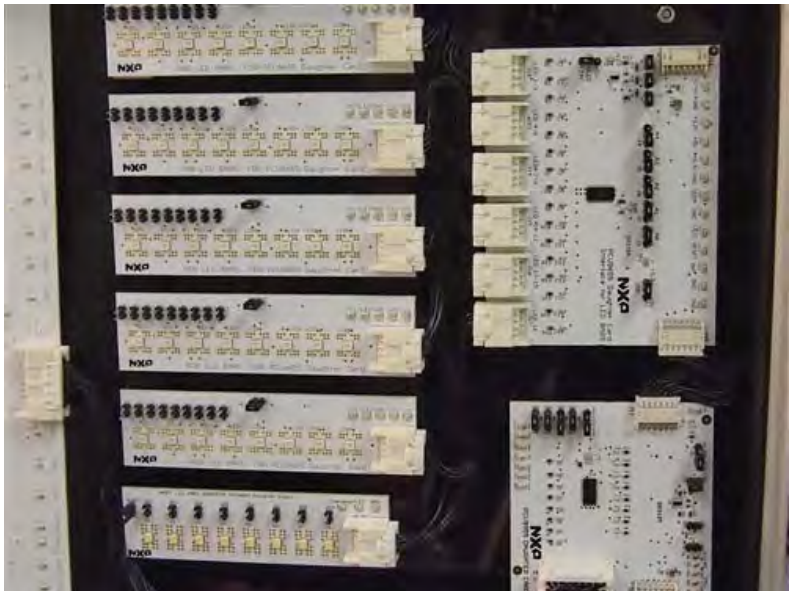

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Fig 9. RGB board connections

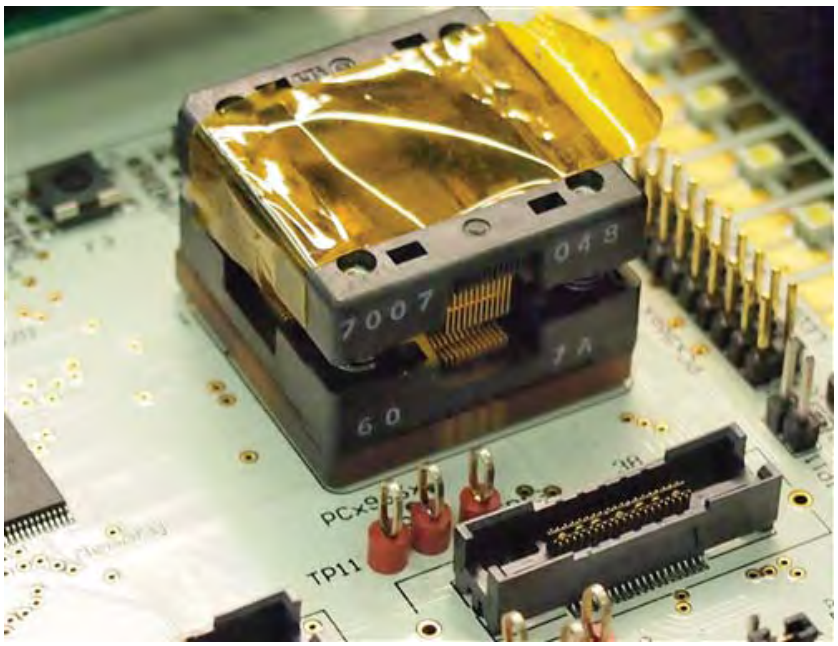

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Fig 10. PCU9669 socket

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3.6.1.3 Power-on

Once the AC-DC adapter is connected to a mains outlet, a total of eight LEDs illuminate to indicate the presence of power on the different power rails.

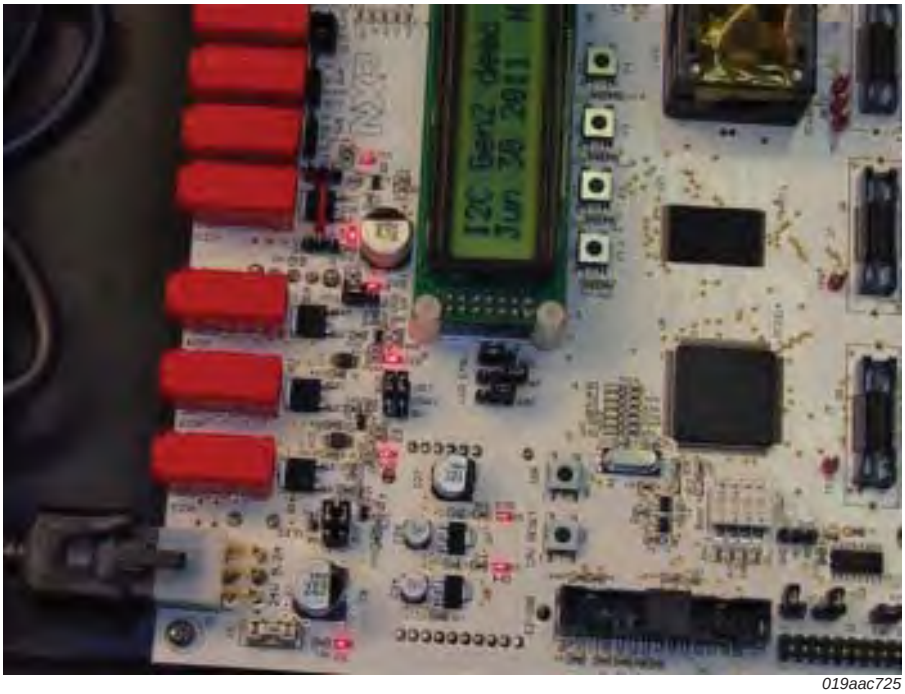

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Fig 11. LED power indicators

The LCD panel will display a message to indicate the demo is ready to run.

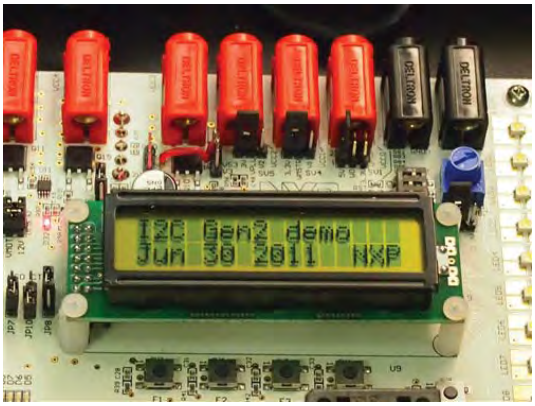

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Fig 12. LCD panel showing a ready status

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To run the auto-demo:

1. Press ‘CPU_RESET’ button.
2. Press ‘F1’ button to run through automated routine. In this mode, all available LED patterns and stepper motor patterns will run in a loop mode.
3. To end the demo, simply press the ‘CPU_RESET’ button.

To run in manual mode:

1. Press ‘CPU_RESET’ button.
2. Press ‘F2’ button to run through the first demonstration routine.
3. To cycle through the different demos, press the ‘F2’ button to move backwards through the routines, or ‘F4’ to move forward. The ‘F3’ button lets the demo pattern again.
4. To exit, press the ‘CPU_RESET’ button.

To check software revision:

1. Press ‘CPU_RESET’ button.
2. Press and hold ‘F3’ or ‘F4’ button to display software revision.
3. Press and hold ‘F3’ or ‘F4’ button again to display software build date and time.
4. To exit, press the ‘CPU_RESET’ button. (This is not necessary. Pressing F1 or F2 starts Auto or Manual demo mode.)

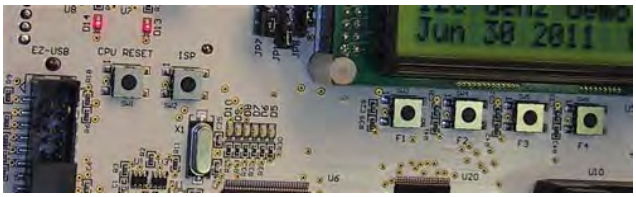

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Fig 13. CPU_RESET and F1 to F4 buttons

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4. Troubleshooting

For issues not covered under this troubleshooting guide, please contact **i2c.support@nxp.com**.

Table 8. Troubleshooting guide

Problem	Solution
LCD displays ‘timeout’, nothing works.	PCU9669 socket might be loose. Assure good contact on PCU9669, then press ‘CPU_RESET’ again. This usually corrects the time-out issue and you can press F1 or F2 to start your routine.
Stepper motor boards will not start.	Press ‘CPU_RESET’ several times, then ‘F1’.
One or more motor board spinners are not ‘in sync’ with other spinners.	Press ‘CPU_RESET’ and restart with ‘F1’.
Spinner not turning, strange sound coming from motor board.	Spinner has been moved and is making contact with optical switch. Move spinner by hand (soft metal), fix bend or placement error until you can rotate by hand through both sensors without touching. Press ‘CPU_RESET’ and ‘F1’.
One or more spinners seem to have incorrect timing, possibly one left motor moving when right board is enabled (as an example).	Address pins are incorrect. Verify address pin locations, and restart demo.
Acting strange, not everything working.	Verify all eight red LEDs on the control board are lit up. If not, possible power supply loss. Can be caused by shorting connections on smaller boards or during ‘hot’ cable changes.
Parts damage seen on motor boards.	14-pin LED cable (which is wired reverse from standard cable) has been plugged into motor boards. PCA9629’s will be blown and need to be replaced as well as any capacitors, inductors or ESD protection diodes before boards will work correctly. Puts +24 V on +5 V line.

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5. Schematics

The following schematics are available from **i2c.support@nxp.com**:

- PCU9669 motherboard with ARM7 LPC2214 microcontroller motherboard:
  PCU966x_V3_20.cct.pdf
- Stepper motor boards (PCA9629):
  pca9629 5-motor design.pdf
- PCU9655 voltage switch LED controller board:
  PCU9655_Daughter_card schematic.pdf
- PCU9955 constant current LED controller board:
  PCU9955_daughter card schematic.pdf
- PCU9655 White LED daughter board:
  PCU9655 WHITE LED Bar1 schematic.pdf
- PCU9655 RGB LED daughter board:
  PCU9955 RGB LED BAR 1 schematic.pdf
- 160 White LED board:
  PCU9955 White 160 LED board schematic.pdf

6. Abbreviations

Table 9. Abbreviations

Acronym	Description
CPU	Central Processing Unit
ESD	ElectroStatic Discharge
Fm+	Fast-mode Plus
I^2C-bus	Inter Integrated Circuit-bus
LCD	Liquid Crystal Display
LED	Light Emitting Diode
MCU	MicroController Unit
PC	Personal Computer
PLL	Phase-Locked Loop
RGB	Red/Green/Blue
SRAM	Static Random Access Memory
UFm	Ultra-Fast mode
USB	Universal Serial Bus

7. References

[1] UM10204, "I^2C-bus specification and user manual" —
Rev. 4, 13 February 2012; NXP Semiconductors;
www.nxp.com/documents/user_manual/UM10204.pdf

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9. Contents

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