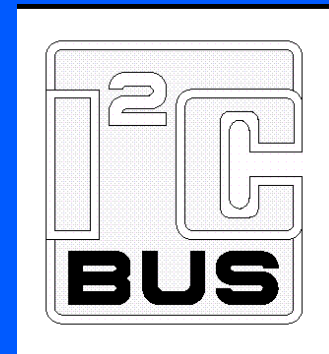


PHILIPS

I²C Evaluation Board Overview

Sept 2002



Agenda

- **Purpose of the I²C Evaluation Boards**
- **Overview of the I2C 2002-1 Evaluation Board Kit**
 - **What is included in the Evaluation Board Kit**
 - **What I²C Devices are on the Evaluation Board**
 - **What are some of the experiments that can be done**
 - **Where to buy the I2C 2002-1 Evaluation Board Kit**
- **Overview of Win-I2CNT Software**
- **Previous I²C Evaluation Boards**
- **Future I²C Evaluation Boards**

Purpose of the Philips I²C Evaluation Board

To provide a low cost platform that allows Field Application Engineers, designers and educators to easily test and demonstrate new I²C devices in a platform that allows multiple operations to be performed in a setting similar to a real system environment.

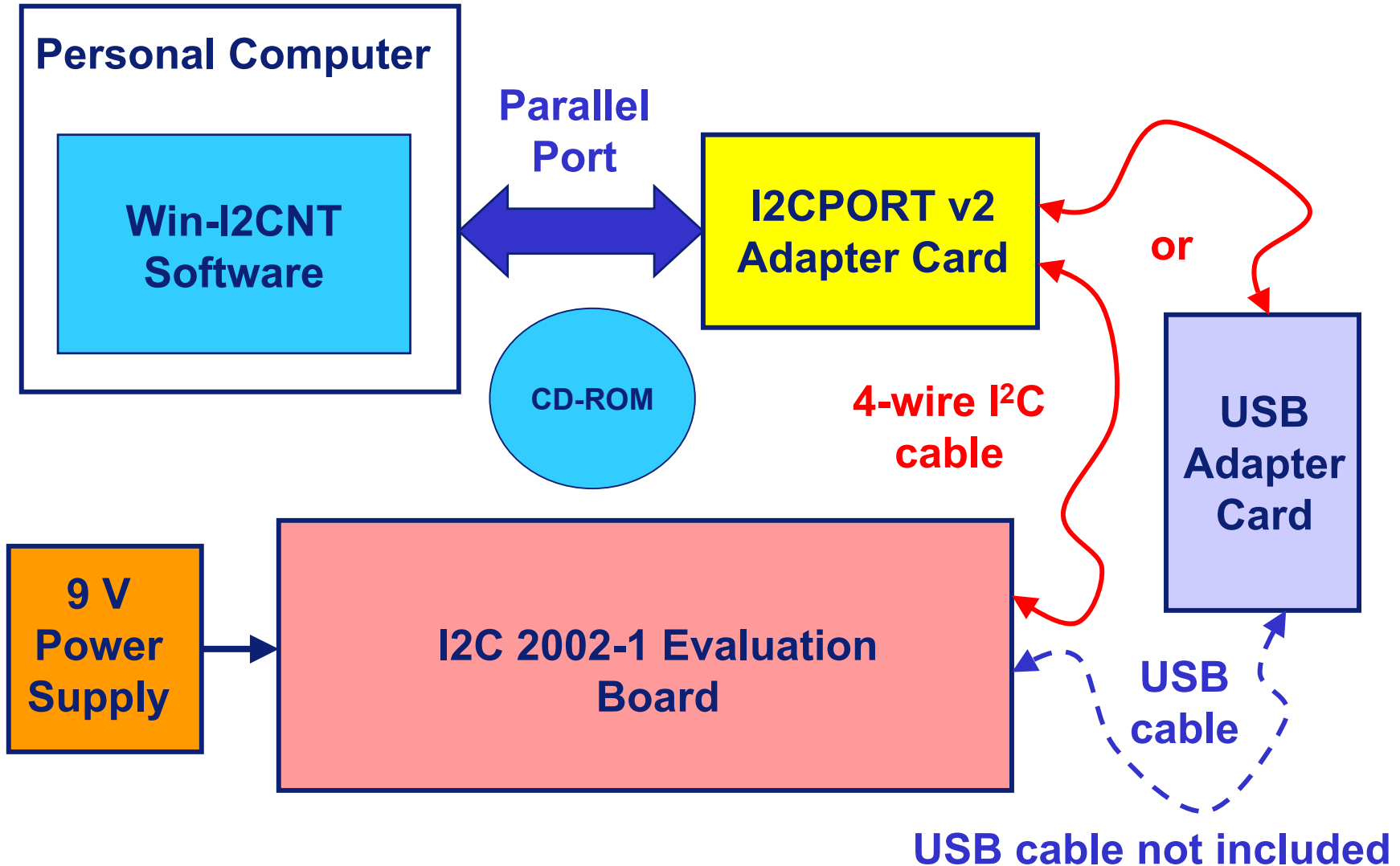
I2C 2002-1 Evaluation Board Kit



- **Kit includes:**

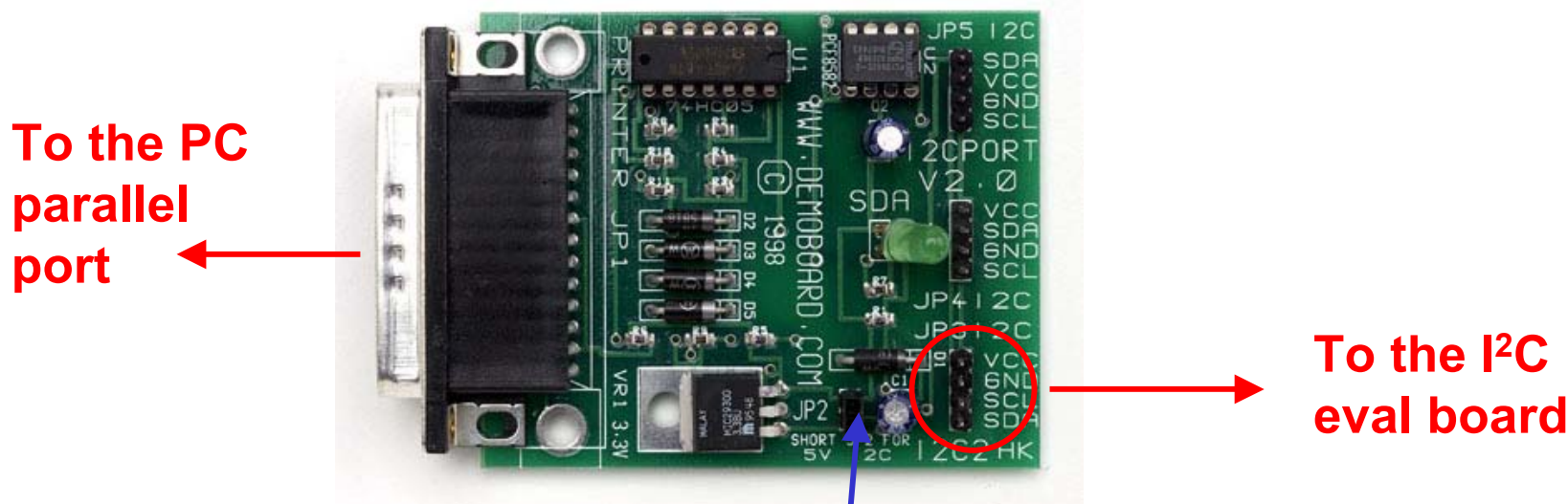
- I2C 2002-1 Evaluation Board
- I2CPORT v2 Adapter Card
- 4-wire Connection Cable
- USB Adapter Card
- 9 V Power supply
- CD-ROM with Operating Instructions and Win-I2CNT (32-bit) software

Kit Components



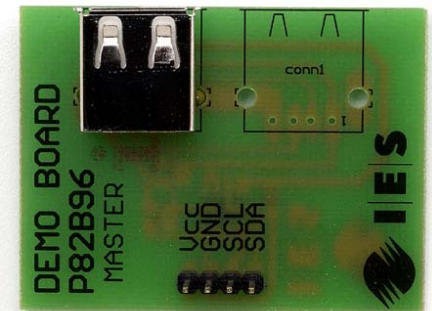
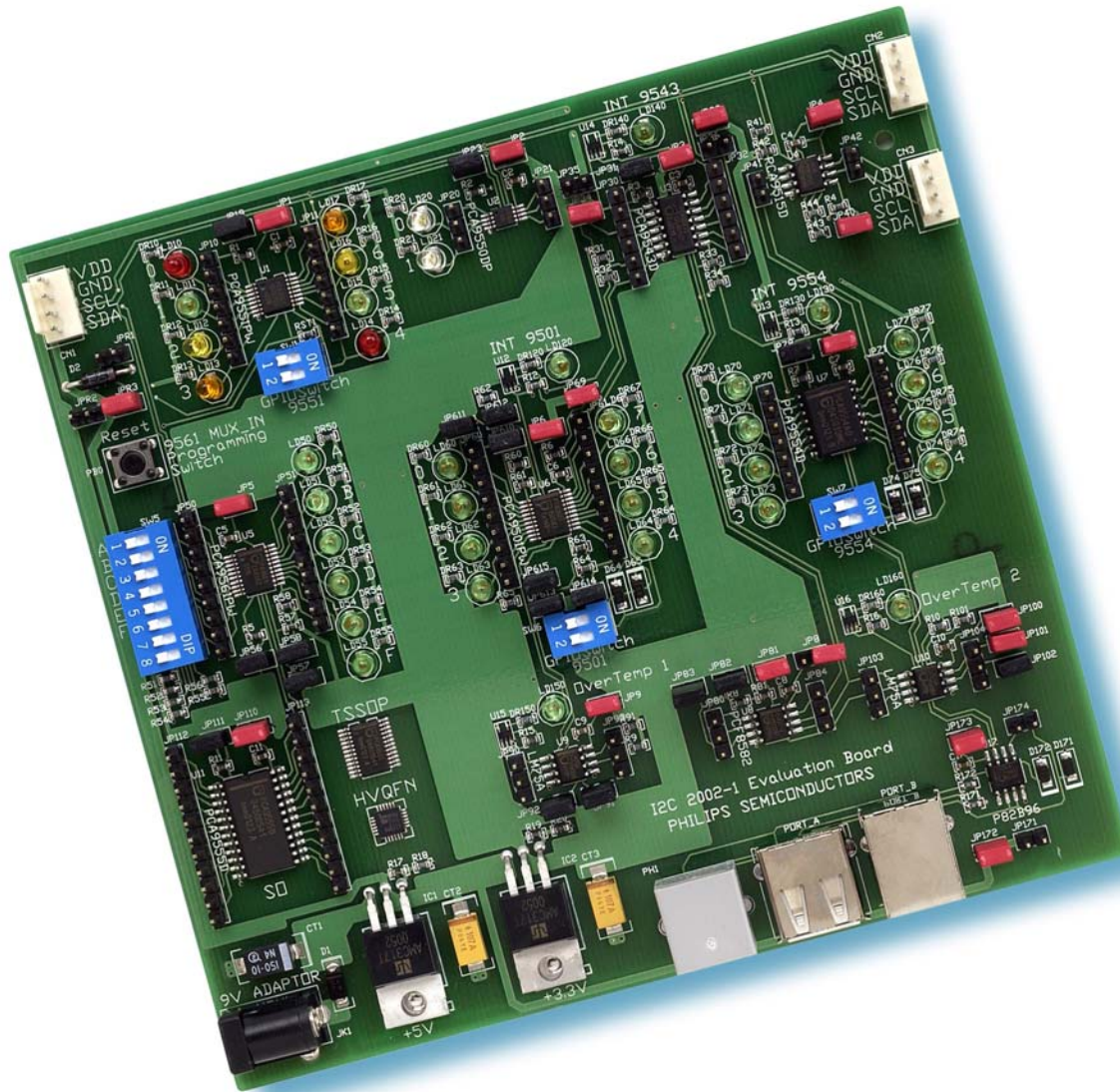
Jumper JP2
I²C Voltage Selection (Bus voltage)
Open = 3.3 V bus
Closed = 5.0 V bus

- The I2CPORT v2 Adapter Card connects to the standard DB-25 parallel port on any Personal Computer (PC)
- It is powered by the PC or by the evaluation board

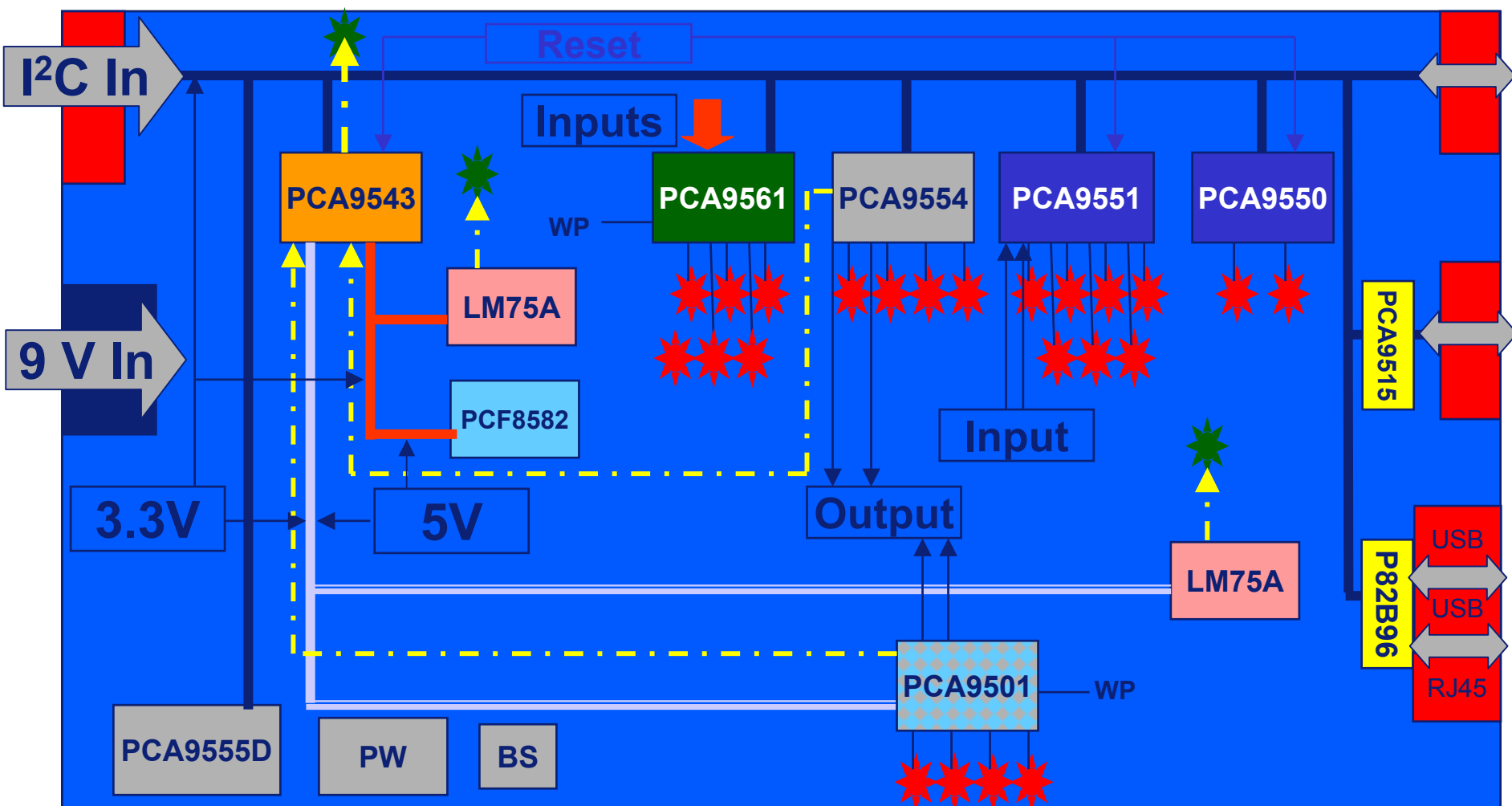


I2C 2002-1 Evaluation Board

USB Adapter Card



I2C 2002-1 Evaluation Board Layout



I²C Devices on the Evaluation Board

DEVICE	FUNCTION	DEFAULT I ² C ADDRESS
PCA9501	2 Kbit EEPROM	B0
	8-bit I/O EXPANDER	30
PCA9543	I ² C SWITCH	E4
PCA9550	2-bit LED Drivers/Blinkers	C0
PCA9551	8-bit LED Drivers/Blinkers	CC
PCA9554	8-bit I/O Expander	40
PCA9555	16-bit I/O Expander	4C
PCA9561	6-bit DIP Switch	98
PCF8582	2 Kbit EEPROM	A0
LM75A_1	Thermal Sensor	90
LM75A_2	Thermal Sensor	92
PCA9515	I ² C Repeater	None
P82B96	Dual Bi-directional Bus Buffer	None

I²C Device Addresses

- All device A0 pins go to jumpers so two of the evaluation boards can be set up with different addresses when connected by the PCA9515, P82B96 or unbuffered.
- Channel 1 EEPROM and temperature sensor A1 pins go to jumper so it is possible to deconflict the address from the Channel 0 EEPROM and temperature sensor.

Why the I²C devices were selected

- **PCA9501** - To show programming difference between PCF8574 and PCA9554 GPIO and that the device has both PCF8574 GPIO and PCF8582C-2 2K EEPROM in the same package with 6 address pins that allow up to 64 devices on bus.
- **PCA9561** - To show use as a dip switch replacement
- **PCA9543** - To show use as a 2 channel multiplexer/switch
- **PCA9554/55** - To show uses of I/O expander as LED driver, input and output to master and to show size comparison of the PCA9555 in three packages, SO, TSSOP and HVQFN
- **PCA9550/51** - To show LED Blinkers ability to blink LEDs and to use unused bits as general purpose inputs and outputs
- **PCF8582C-2** - To show 2K EEPROMs and have a device to multiplex.
- **LM75A** - To show temperature sensors and have a device to multiplex.
- **PCA9515 and P82B96** - To show some of the devices that can expand the I²C bus and to show how the P82B96 can be used to send both I²C and the supply power through USB cables or telephone wires.

Evaluation Board Experiments

- **Program and Blink LEDs using the GPIOs and/or the LED Blinker devices.**
 - Learn differences in programming and blinking LEDs using the older and newer GPIO and the 2/8-bit LED Blinkers
 - See LED Blinker continue to blink LEDs when I²C bus is disconnected
- **Command temperature sensors and 2K EEPROMs with same and different addresses through the PCA9543 two channel switch (used as multiplexer and for voltage translation between 3.3 and 5V).**
 - Learn how switch, 2K EEPROMs and temperature sensors work
 - See what happens when send commands to devices with same address at the same time
 - See temperature sensor response at different voltage levels
- **Program the Mux I²C EEPROM as a dip switch replacement.**

How To Obtain the New Evaluation Kit

- The I2C 2002-1 Evaluation Board Kit consists of the:
 - I2C 2002-1 Evaluation Board
 - I2CPort v2 Adapter Card for the PC parallel port
 - 4-wire connector cable
 - USB Adapter Card (no USB cable)
 - 9 V power supply
 - CD-ROM with operating instructions and Win-I2CNT software on that provides easy to use PC graphical interface specific to the I²C devices on the evaluation board but also with general purpose mode for all other I²C devices.

**Purchase the I2C 2002-1 Evaluation Board Kit
at www.demoboard.com**

Starting the Software

Clicking on the Win- I2CNT icon will start the software and will give the following window

The screenshot shows the Win-I2CNT software window with the following annotations:

- Working Window Selection:** Points to the main window area.
- Open the device specific screen:** Points to the 'LED Drivers/Blinkers' menu item.
- 2 modes for the clock. Slow is adequate for slow ports and to solve some potential compatibility issue:** Points to the 'Normal' and '100 KHz' options in the status bar.
- I²C Indicates the clock (SCL) frequency:** Points to the '100 KHz' option in the status bar.
- Parallel Port:** Points to the 'LPT1' option in the status bar.
- Help Hints:** Points to the 'Help' menu item.
- Indicates that I²C communications can start:** Points to the 'Win-I2CNT hardware ready at LPT1' message in the status bar.
- If problem, message "WIN-I2C hardware not detected" displayed → Action: check Adapter Card:** Points to the status bar area.

Step 3: If necessary, adjust the I²C operating frequency in the Options Menu

Step 4: Select a device, or create your own I²C device using the Universal or User Defined selections, from the Device Menu

Device → I/O Expanders → PCA9501

GPIO register value

GPIO value

GPIO Read / Write Options

GPIO programming

GPIO address

EEPROM address

Selected byte information

Write Time

EEPROM Read / Write Options

Set the all EEPROM to the same value

Auto Write Feature

Byte 8B_H or 139₁₀

EEPROM programming

I2CWin-I2CNT - [PCA9500 / PCA9501 System Maintenance and Control Devices]

File Device Options Window Help

I/O Expander

Address (hex) **80** P7 P6 P5 P4 P3 P2 P1 P0 **FF** Write I/O Read I/O ☒ Auto Write Off

EEPROM Address

Word Address

Write Time (ms)

Read Byte Read All Write Byte Write All

Preset

Set Data **FF**

	0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
0	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
1	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
2	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
3	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
4	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
5	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
6	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
7	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
8	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
9	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
A	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
B	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
C	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
D	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
E	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF
F	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF	FF

Enter a two digit hex number into each cell

Normal 100 KHz LPT1

Device → Multiplexers/Switches → PCA9543

The screenshot displays the Win-I2CNT software interface for configuring I2C devices. The title bar indicates the current device is PCA9543. The interface is divided into four panels, each representing a different device: PCA9543, PCA9545, PCA9546, and PCA9548. Each panel contains the following elements:

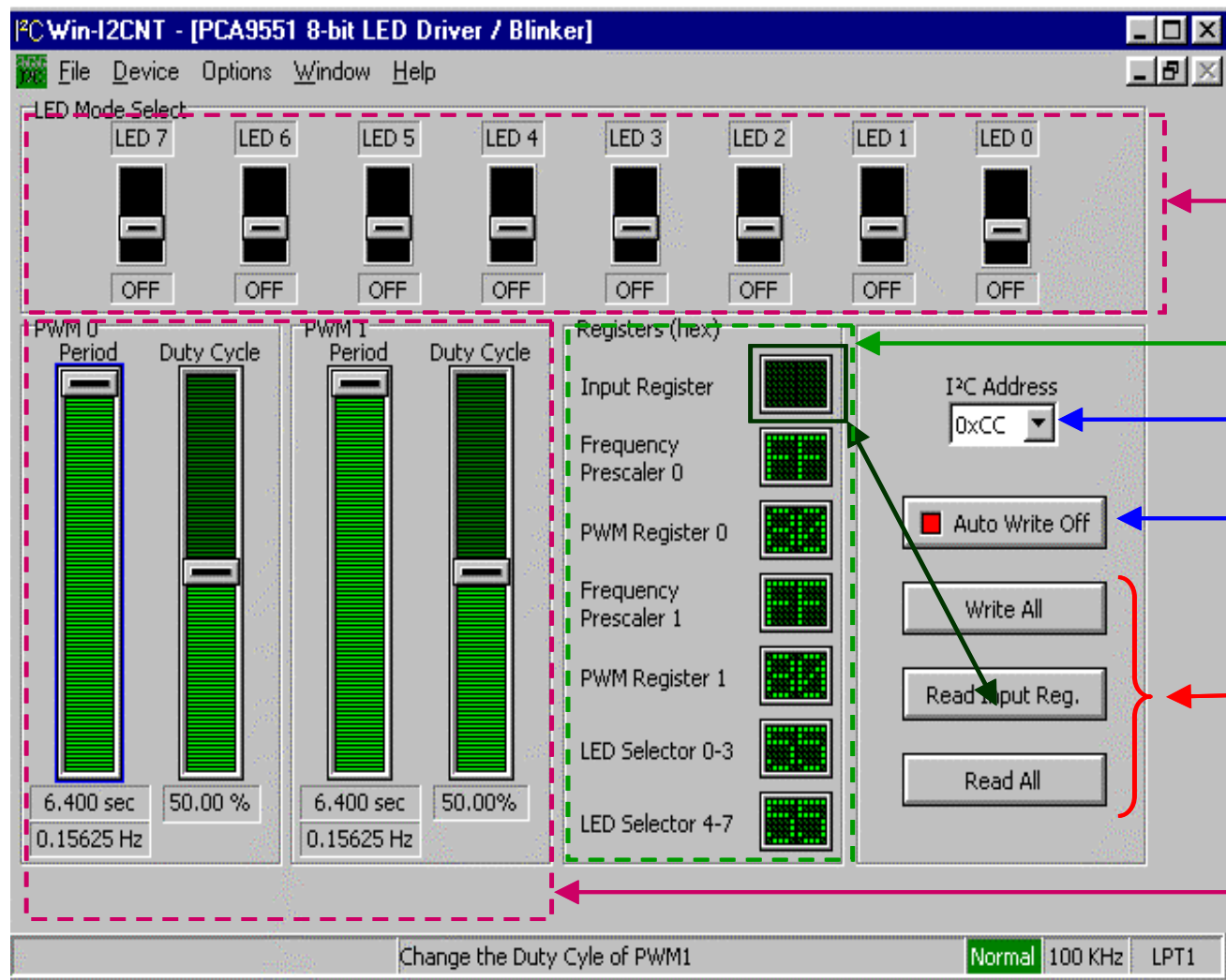
- Device Address:** A dropdown menu showing the current address (0xE4 for PCA9543, 0xE0 for the others).
- Control Register:** A green 8-bit display showing the current register value, with Read and Write buttons below it.
- Channel Select:** A group of checkboxes for selecting channels (Channel 0, Channel 1, Channel 2, Channel 3 for PCA9543, PCA9545, and PCA9546; up to Channel 7 for PCA9548).
- Interrupts:** A group of checkboxes for enabling interrupts for each channel.
- Auto Write Off:** A checkbox to toggle the auto-write feature.

Annotations on the left side of the image point to specific features:

- Device address:** Points to the Device Address dropdown in the PCA9543 panel.
- Control Register Value:** Points to the green 8-bit display in the PCA9543 panel.
- Read / Write Operation:** Points to the Read and Write buttons in the PCA9543 panel.
- Channel Selection:** Points to the Channel Select checkboxes in the PCA9543 panel.
- Interrupt Status:** Points to the Interrupts checkboxes in the PCA9543 panel.
- Auto Write Feature:** Points to the Auto Write Off checkbox in the PCA9543 panel.

At the bottom right of the interface, there are status indicators for the I2C bus: Normal, 100 KHz, and LPT1.

Device → LED Drivers/Blinkers → PCA9551



LED drivers states

Register values

Device address
Auto Write Feature

Read / Write Operation

Frequencies and duty cycles programming

Device → I/O Expanders → PCA9554

The screenshot shows the I2CWin12CNT software interface for configuring PCA9554/PCA9554A I/O Expanders. The interface includes a menu bar (File, Device, Options, Window, Help) and a status bar at the bottom.

Annotations and Labels:

- Auto Write Feature:** Points to the "Auto Write Off" checkbox.
- Device address:** Points to the "Device Address" dropdown menu showing "0x40".
- Input Register:** Points to the "Input" section of Register 0.
- Output Register:** Points to the "Output" section of Register 1.
- Read / Write Operation (all registers):** Points to the "Read All" and "Write All" buttons.
- Configuration Register:** Points to the "Configuration" section of Register 3.
- Polarity Register:** Points to the "Polarity" section of Register 2.
- Register Programming:** Points to the "Read" and "Write" buttons for a specific register.
- Read / Write Operation (specific register):** Points to the "Read" and "Write" buttons for Register 3.

Register Details:

Register	Section	Value	Bit	Setting
Register 0 (Input)	Input	FF	I7	High
			I6	High
			I5	High
			I4	High
			I3	High
			I2	High
			I1	High
			I0	High
Register 1 (Output)	Output	FF	O7	High
			O6	High
			O5	High
			O4	High
			O3	High
			O2	High
			O1	High
			O0	High
Register 2 (Polarity)	Polarity	00	N7	Not Inverted
			N6	Not Inverted
			N5	Not Inverted
			N4	Not Inverted
			N3	Not Inverted
			N2	Not Inverted
			N1	Not Inverted
			N0	Not Inverted
Register 3 (Configuration)	Configuration	FF	C7	Input
			C6	Input
			C5	Input
			C4	Input
			C3	Input
			C2	Input
			C1	Input
			C0	Input

Checked=high. Unchecked=low. Normal 100 KHz LPT1

Device → I/O Expanders → PCA9555

Auto Write
Feature

Polarity
Registers

Input
Registers

Read / Write Operation
(all registers)

Device
Address

Register
Programming

Configuration
Registers

Output
Registers

Read / Write
Operation
(specific Register)

PCWin-I2CNT - [PCA9555 16-bit I/O Expander]

File Device Options Window Help

Device Address: Auto Write Off ☐

Input (Registers 1 and 0): Read Inputs

Write All Read All

Configuration (Registers 7 and 6):

7.7 ☒ Input 6.7 ☒ Input
7.6 ☒ Input 6.6 ☒ Input
7.5 ☒ Input 6.5 ☒ Input
7.4 ☒ Input 6.4 ☒ Input
7.3 ☒ Input 6.3 ☒ Input
7.2 ☒ Input 6.2 ☒ Input
7.1 ☒ Input 6.1 ☒ Input
7.0 ☒ Input 6.0 ☒ Input

Write Config Regs Read Config. Register

Polarity (Registers 5 and 4):

5.7 ☐ Not Inverted 4.7 ☐ Not Inverted
5.6 ☐ Not Inverted 4.6 ☐ Not Inverted
5.5 ☐ Not Inverted 4.5 ☐ Not Inverted
5.4 ☐ Not Inverted 4.4 ☐ Not Inverted
5.3 ☐ Not Inverted 4.3 ☐ Not Inverted
5.2 ☐ Not Inverted 4.2 ☐ Not Inverted
5.1 ☐ Not Inverted 4.1 ☐ Not Inverted
5.0 ☐ Not Inverted 4.0 ☐ Not Inverted

Write Polarity Reg. Read Polarity Port

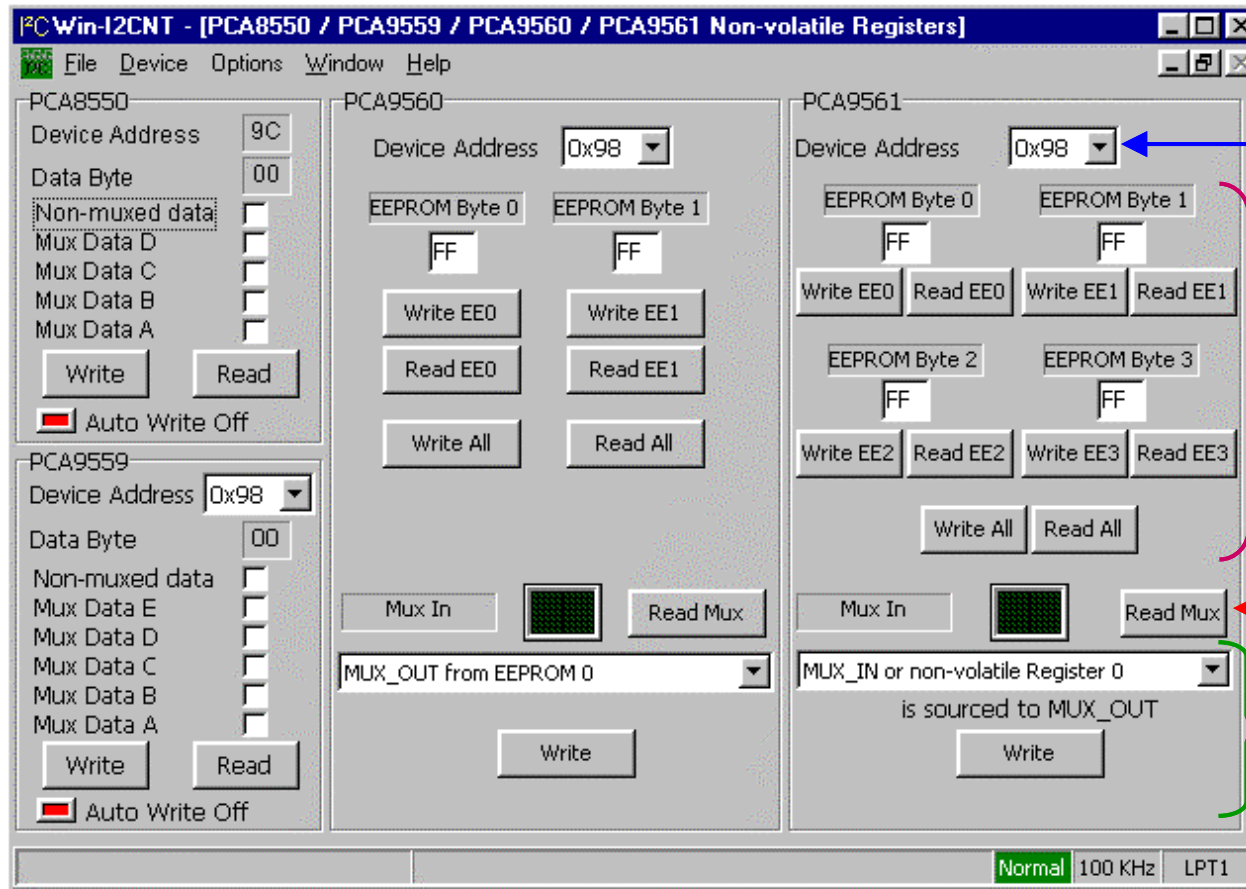
Output (Registers 3 and 2):

3.7 ☒ High 2.7 ☒ High
3.6 ☒ High 2.6 ☒ High
3.5 ☒ High 2.5 ☒ High
3.4 ☒ High 2.4 ☒ High
3.3 ☒ High 2.3 ☒ High
3.2 ☒ High 2.2 ☒ High
3.1 ☒ High 2.1 ☒ High
3.0 ☒ High 2.0 ☒ High

Write Output Port Read Output Port

Checked=high, Unchecked=low. Normal 100 KHz LPT1

Device → Non-Volatile Registers → PCA9561



Device Address

EEPROMs Read / Write Operation

MUX_IN Read Operation

Data (EEPROM, MUX_IN) Multiplexing

Note: MUX_IN, MUX_SELECT and WP pins are not controlled by the Software

Device → Thermal Management → LM75A

Auto Write Feature

Read / Write Operation (all registers)

Temperature Monitoring

Device address

Read / Write Operation (specific register)

Device modes

PCWin-I2CNT [LM75A Digital Temperature and Thermal Watchdog]

File Device Options Window Help

Device Address: 0x90 Automatic Write: ☐ Auto Write Off

Read and Write All Registers: Write All Read All

Temperature: Read Temp Register: 0x0000 Temperature: 25.000°C

Thyst: Read Write Thyst Register: 0x4B00 Thyst Temperature: 75.0°C

TOS: Read Write TOS Register: 0x5000 TOS Temperature: 80.0°C

Configuration Register: Read Write Configuration: 0x00

Shut-down: Normal OS Polarity: Low OS Mode: Comparator OS Fault Queue: 1

Temperature History: 30 25 20 15 10 5 0

Read every: 500 milliseconds Start Read

Normal 100 KHz LPT1

Temperature Programming

Monitoring Frequency

Start Monitoring

Device → EEPROM → 256 x 8 (2K)

- Control window and operating scheme same as PCA9501's 2 Kbit EEPROM

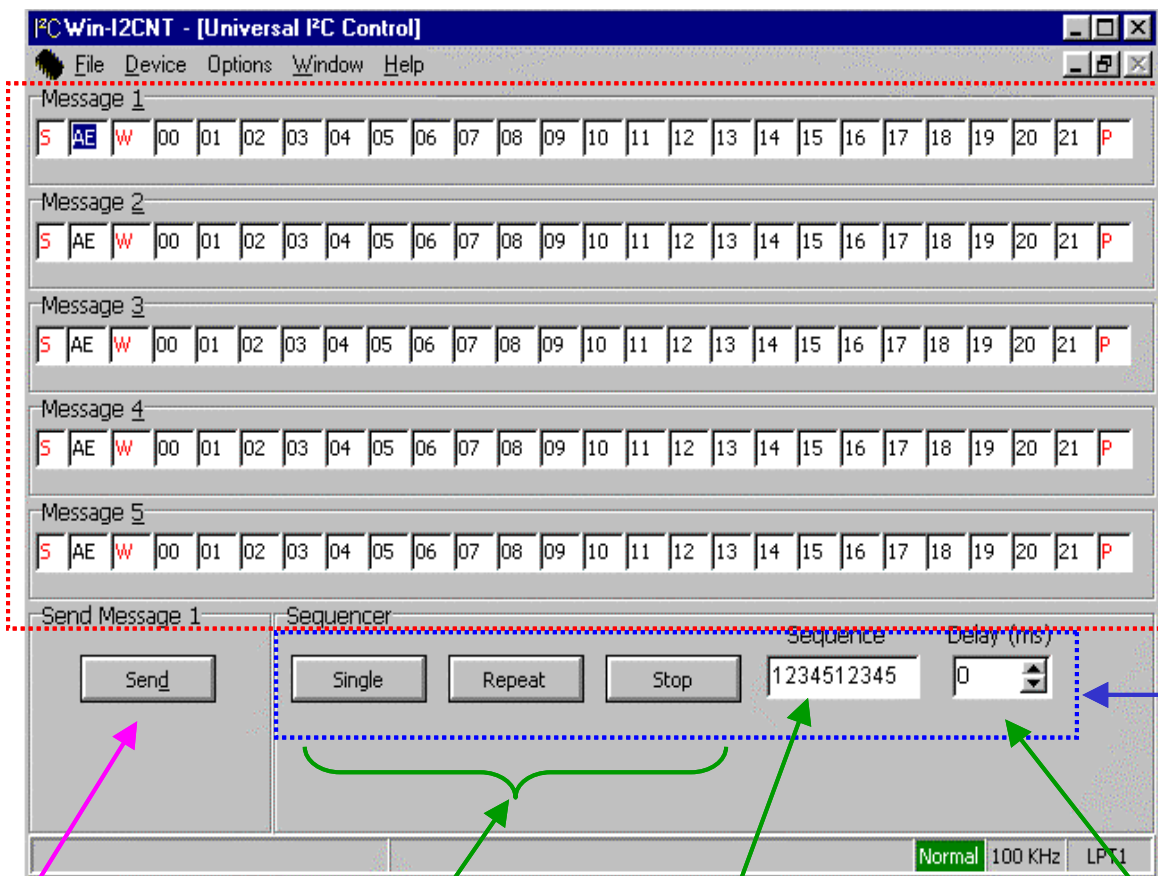
PCA9515

- Bus repeater - No software to control it
- Buffered I²C connector available
- Enable Control pin accessible

P82B96

- Bus buffer - No software to control it
- I²C can be sent through RJ11 and USB cables to others boards
- 5.0 V and 9.0 V power supplies

Universal Receiver / Transmitter Screen



**Commands
Programming**

**I²C
sequencing
parameters**

**Send selected
message**

Sequencer

**Sequence
programming**

**Programmable delay
between the messages**

How to program the Universal Screen?

- Length of the messages is variable: 20 instructions maximum
- 5 different messages can be programmed
- First START and STOP instructions cannot be removed
- I²C Re-Start Command → “S” key
- I²C Write Command → “W” key
- I²C Read Command → “R” key
- Add an Instruction → “Insert” key
- Remove an Instruction → “Delete” key
- Data: 0 to 9 + A to F keys

Some other interesting features

- **I²C clock frequency can be modified (Options Menu).**
- **Acknowledge can be ignored for stand alone experiment (Options Menu).**
- **Universal Transmitter/Receiver program can be saved in a file.**
- **Device specific screens are different depending on the selected device. All the options are usually covered in those screens. Good tool to learn how the devices work and test all the features.**
- **Possibility to build some small applications by connecting the devices together through the headers.**

Previous Philips I²C Evaluation Boards

- OM1022 Bus Controller (Year 199X) - **Obsolete**
- S87COOK SD Target Board (Year 199X) - Orderable
- OM5027 Target Board (Year 199X) – Orderable
- I2C 2000-1 Evaluation Board (Year 2000) - **Obsolete**
- I2C 2001-1 Evaluation Board (Year 2001)- **Obsolete**

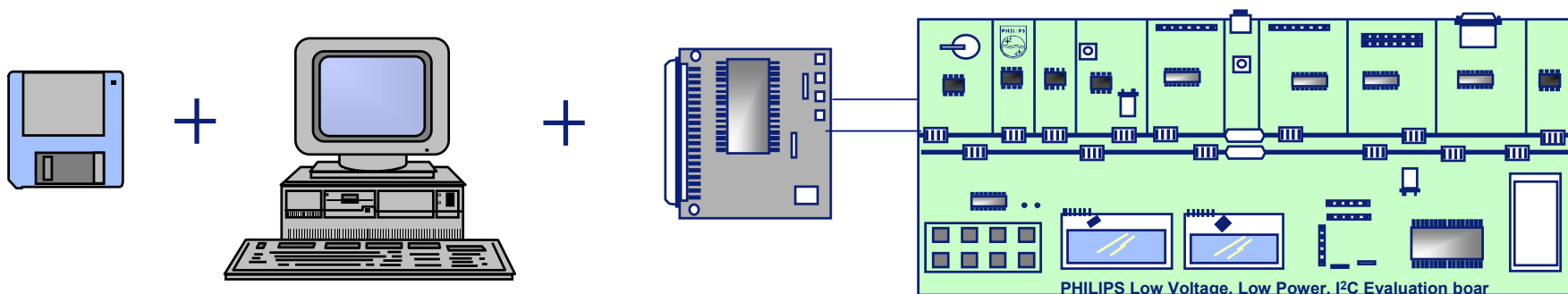
S87COOK SD and OM5027 can be ordered by visiting
www.PDS51.com - specializing only in Philips Microcontroller
Support Tools

For questions, e-mail PC.MB.SVL@philips.com

OM1022 I²C-Bus Analyzer for the PC

Features:

- Menu-driven PC-based I²C -bus interface for monitoring and controlling any I²C target system.
- Includes Software and centronics printer port adapter.
- Software includes:
 - Database with device-data.
 - Universal menu to tailor your own I²C -bus messages, allowing communication with any I²C peripheral.
 - Database transceiver menu for various application-specific ICs
 - Tracer to trace the data transmitted via the I²C -bus
 - Special dedicated menus for specific I²C -bus devices
 - 12NC = 9339 931 00112



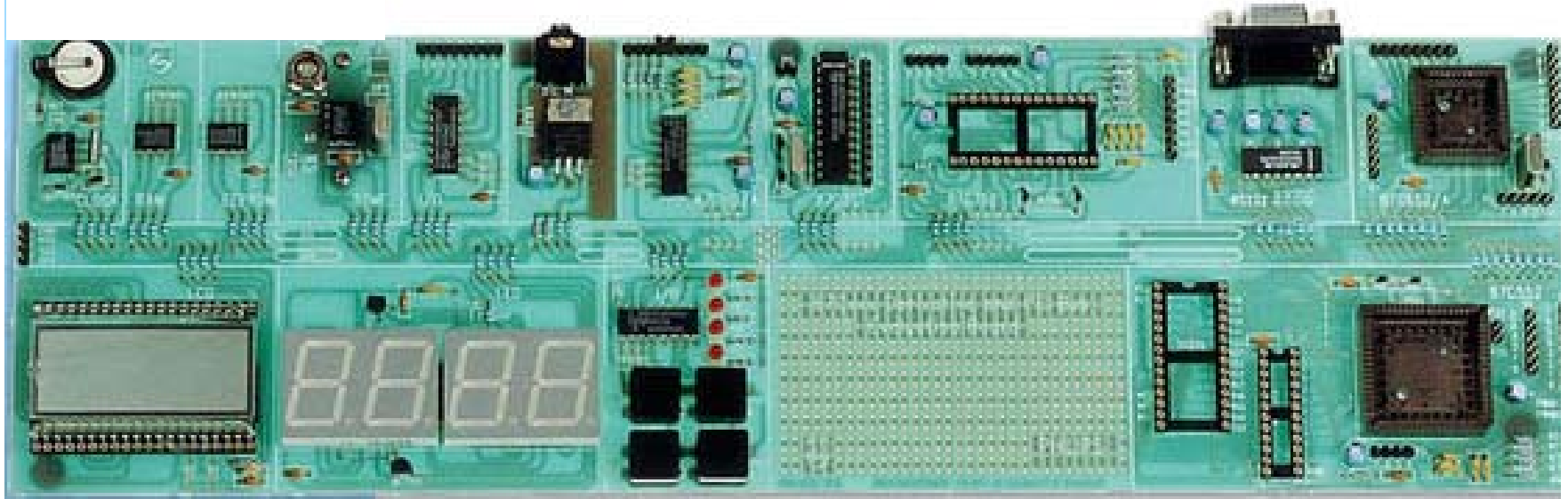
**I²C Analyzer
Program**

IBM-compatible PC

**OM1022 Printer Port
Adapter**

**TARGET I²C SYSTEM
(for ex; OM5027 demo)**

S87C00K SD Evaluation Board

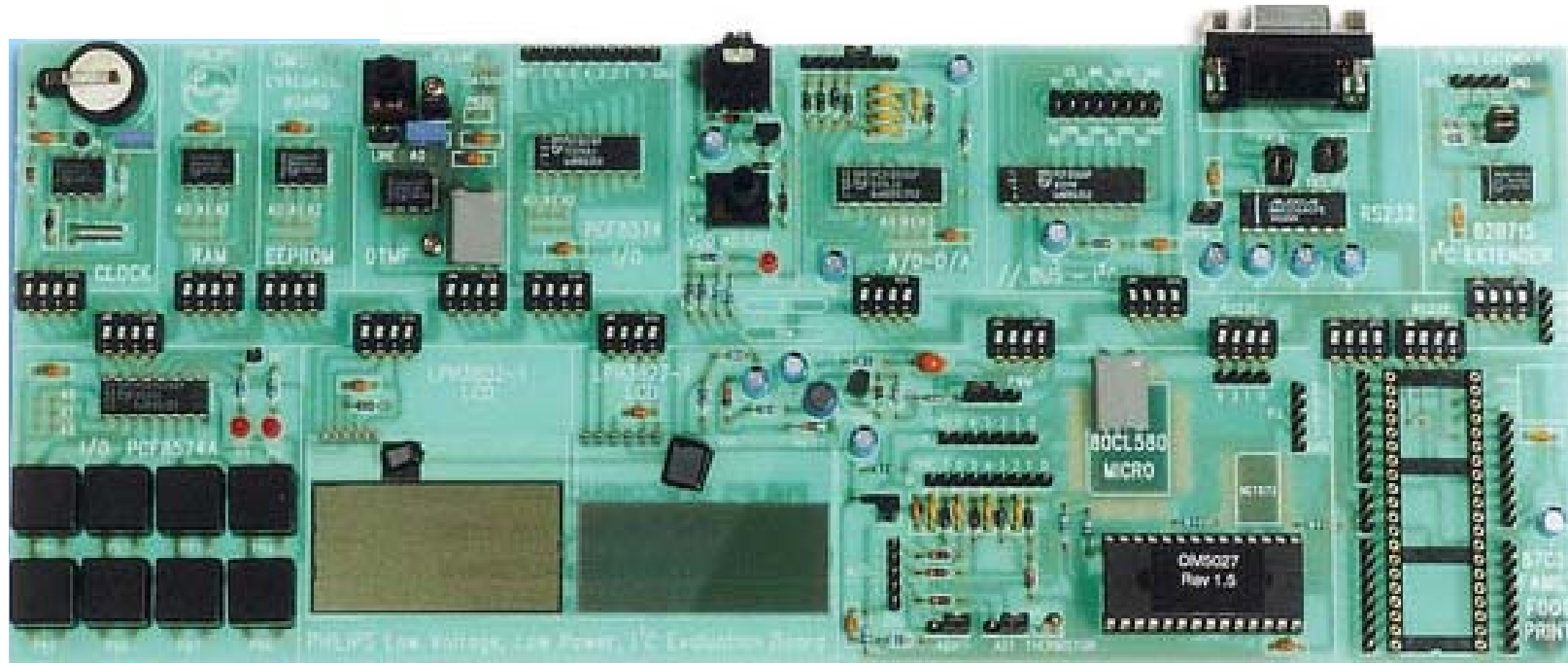


S87C00K SD Evaluation Board

The S87C00K SD Evaluation Board is a low cost, board-level product designed for evaluation of the I²C bus and Philips 80C51 microcontrollers. Its modular board layout and modular software make it useful for fast prototyping and as an educational tool.

Modules on the Board: Microcontroller (87C751), LCD Display (PCF8577 / LTD226F-12), LED Display (SAA1064), 8-bit Parallel I/O (PCF8574A and PCF8574), RAM (PCF8570), EEPROM (PCF8582), Clock/Calendar (PCF8583), DTMF Dialer (PCF3312 / TDA7050T), A/D and D/A (PCF8591), Socket for 87C752, Socket for 87C654/528, Socket for 87C552 with external RAM and Latch, RS232 Interface, Prototyping Area. 12NC is 9350 252 20602.

OM5027 Evaluation Board



OM5027 Evaluation Board

The OM5027 evaluation board provides a working I²C-bus system which may be used for familiarization with and design of I²C-bus hardware and software. The modular construction and central bus allow the board to be used as a quick prototyping aid, and provide for extension to other circuits as required.

Modules on the board: Microcontroller (80CL580 or 83CL580), LCD (segment display LPH3802-1 with PCF8578), LCD (dot-matrix display LPH3827-1 with PCF2116A), 8-bit I²C to parallel I/O (PCF8574 and PCF8574A), RAM (PCF8570), EEPROM (PCA8581), Clock/Calendar (PCF8593), DTMF/Tone generator (PCD3312 with TDA7050), A/D (PCF8591), Parallel bus to I²C interface (PCF8584), I²C extender (P82B715), Power supply board, RS232 interface, documentation and commented source code on floppy disk. 12NC is 9351 522 90112.

I2C 2000-1 Evaluation Board



I2C 2000-1 Evaluation Board

DEVICE	FUNCTION	DEFAULT I ² C ADDRESS
PCA8550	Non-Volatile Register	9C
PCA9540	I ² C Multiplexer	E0
PCA9542	I ² C Multiplexer	EC
PCA9544	I ² C Multiplexer	EE
PCA9556	I/O Expander	3E
PCA9559	Non-Volatile Register	9E
PCF8575	I/O Expander	4E
PCK2001	Clock Buffer	69
NE1617	Thermal Management	30

- Headers available for all the devices for monitoring or function plug
- All the devices share the same I²C bus

I2C 2001-1 Evaluation Board



I2C 2001-1 Evaluation Board

DEVICE	FUNCTION	DEFAULT I ² C ADDRESS
PTN3500	I/O Expander	4E
	EEPROM	AE
PTN3501	I/O Expander	7E
	EEPROM	FE

- **Caution: potential address conflict between PTN3500 EEPROM and PCF8582C-2 in the port adapter card (remove the device if necessary)**
- **JP3 controls the “WC” pins - Jumper necessary between pins 2 and 3 when EEPROM writing needs to be performed (WC pin to Ground)**
- **The PTN3500A/01A have been renamed PCA9500/01**

Future Evaluation Board

Possible Devices:

Bus Controller

Temperature Sensor

Microcontroller

Real Time Clock

LCD Display Driver

LED Blinker/Dimmer

EEPROM

Multiplexer/Switch

DIP Switch

Bus Buffer

I/O Expander

Analog Digital Converter

DTMF

