UM0213
User Manual

STFPC311 Evaluation Board
Hardware Description and User Guide

Introduction

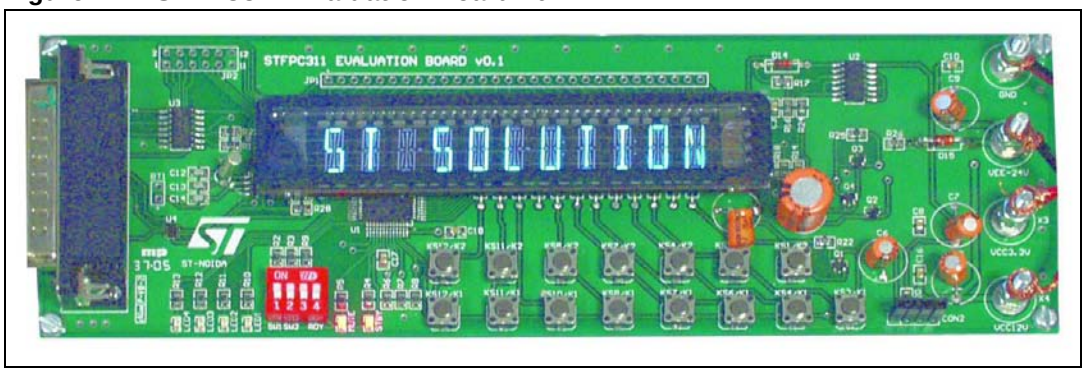
The STFPC311 is an evaluation board designed for quick and easy evaluation of STFPC311 Vacuum Fluorescent Display (VFD) Controller. The key features include:

- 17-segment, 11-digit VFD,
- 15 programmable Front Panel keys,
- 2 switches,
- 4 LEDs,
- 2 LEDs to display Standby and Mute status,
- 1 InfraRed (IR) Connector for remote control (RC),
- Parallel Port for communication with PC,
- External power supply to power up the controller and VFD Filament, and
- STFPC311 Graphical User Interface (GUI) to demonstrate communication to the VFD controller as it has been interfaced with a micro controller.

The evaluation board package includes:

- 1 STFPC311 board (see *Figure 1*),
- STFPC311 GUI, and
- User manual.

Figure 1. STFPC311 Evaluation Board v0.1



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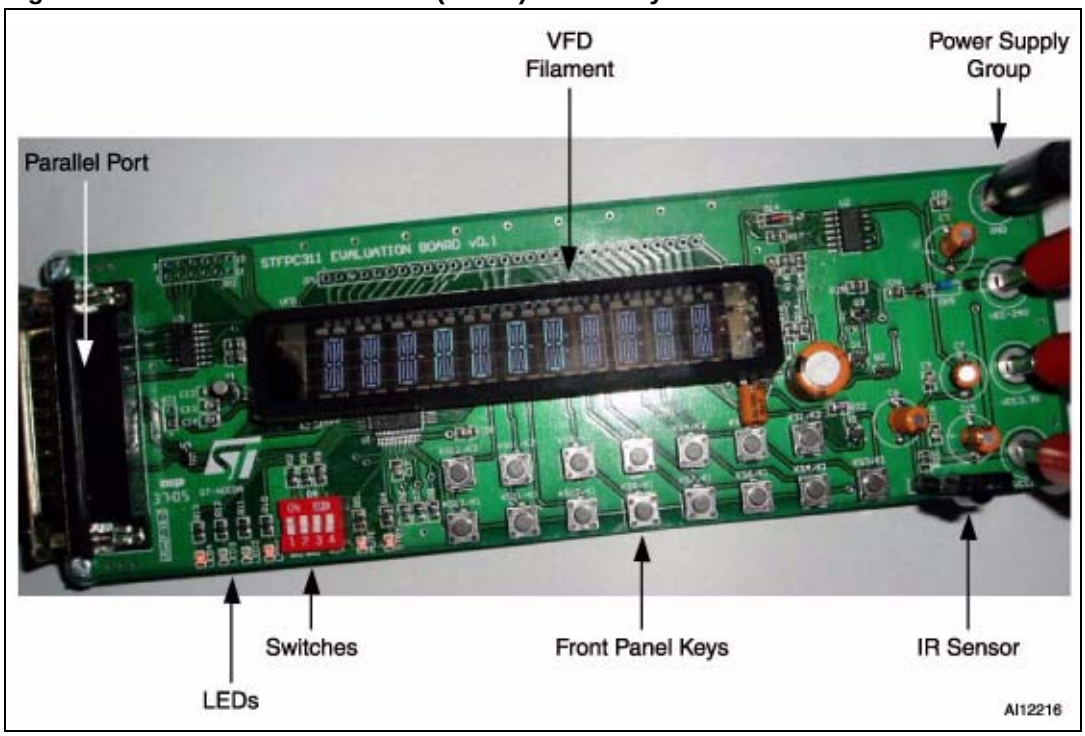
1 Getting Started

The board needs to be powered externally (supply is not provided). The characteristics of an appropriate power supply (group) are:

- $-30V_{DC}$ to $-24V_{DC}$ (drives the VFD Filament),
- $3.3V_{DC}$ (drives the VFD Controller),
- $12V_{DC}$ (drives other components, such as the transistor), and
- 3 connectors with a common ground which are provided on the board (see *Figure 2*).

1.1 STFPC311 Demo Board Layout

Figure 2. STFPC311 Evaluation (Demo) Board Layout



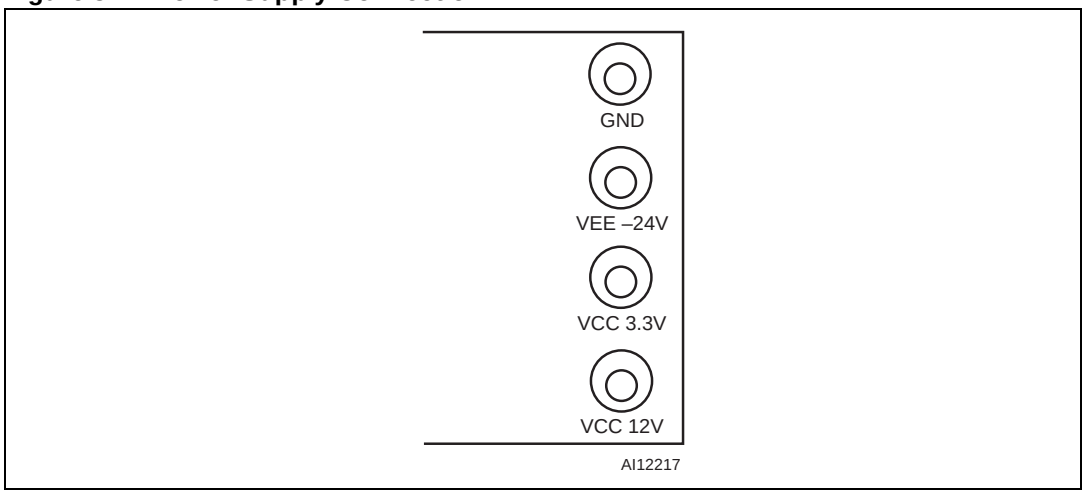
1.2 Software Installation

The GUI is supplied in a ZIP file, “STFPC311_GUI.ZIP”. Unzip this file to obtain the STFPC311_GUI.exe setup file. Double-click on the setup file to install the GUI on the host system.

1.3 Connecting the Board

1. Plug the power supply group into the board (see *Figure 3*).
2. Connect the parallel cable to the host system (see *Figure 2 on page 4*).

Figure 3. Power Supply Connection



2 Starting the Demo Application

1. Start the STFPC311_GUI.
2. Configure the parallel port (“LPTx Setting” window) using the GUI (see *Figure 4*).
3. Turn the evaluation board power ON.
4. Select the READY HIGH radio button (within 10 seconds of power-on), which is located on the WDT and STANDBY tab (see *Figure 5 on page 7*). The Standby and Mute LEDs on the board will light up.

   Note: When the GUI is invoked for the first time, the READY HIGH radio button is selected.

2.1 WDT AND STANDBY Tab

- The “Timer Setting” pull-down menu in the “WATCHDOG TIMER” frame enables the user to specify the Watchdog Timer’s time-out period.
- The “Reset Timer” button is used to reset the Watchdog Timer count.
- The “WATCHDOG ACTION SETTING” frame enables the user to program the time-out event which tells the VFD controller to either go into STANDBY mode or remain in its current state (“No Action”) by selecting the appropriate radio buttons (see *Figure 5*).

Figure 4. Configure Parallel Port

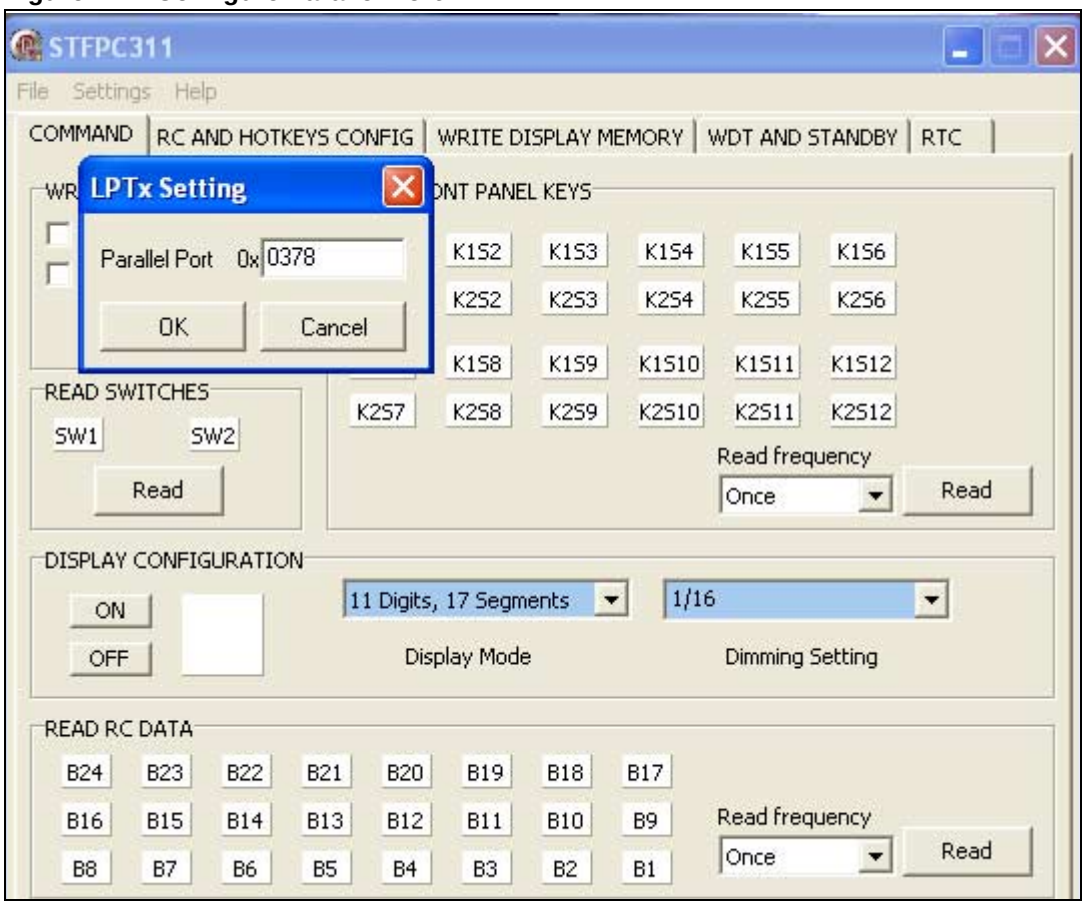
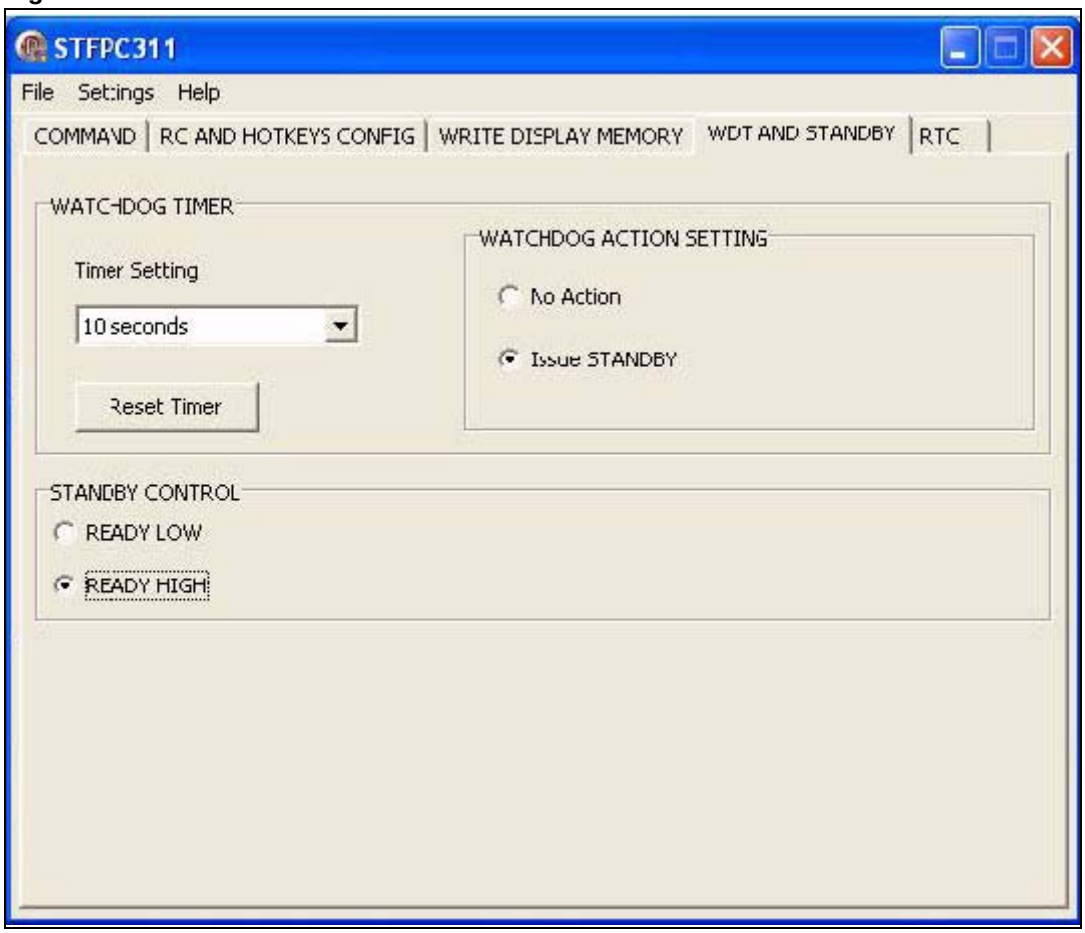


Figure 5. READY HIGH Selection

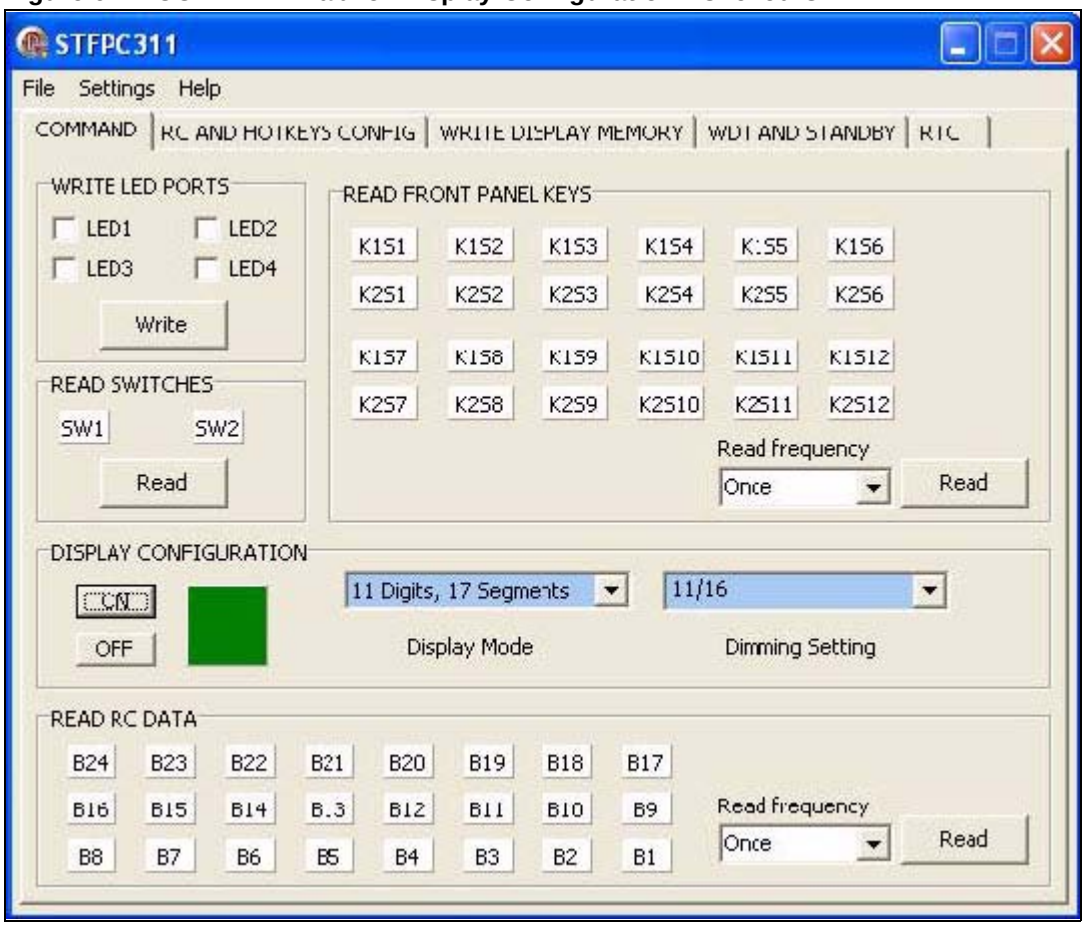


2.2 COMMAND Tab

2.2.1 Configuring the Display

Selecting the appropriate digits, segments, and dimming settings to configure the VFD (see *Figure 6*).

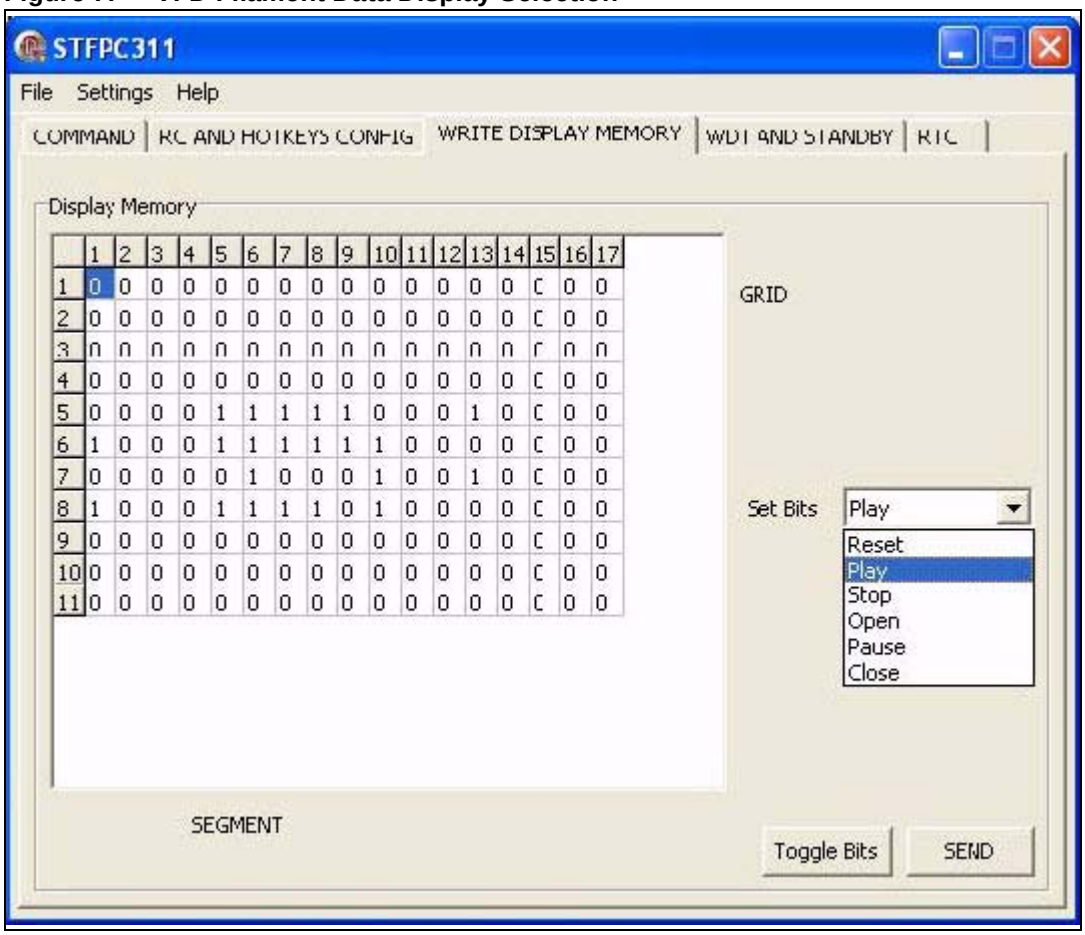
Figure 6. COMMAND Tab for Display Configuration - Clicked ON



2.3 WRITE DISPLAY MEMORY Tab

This tab allows the user to select the data to be seen on the VFD controller (see *Figure 7*).

Figure 7. VFD Filament Data Display Selection



2.4 Returning to the COMMAND Tab

2.4.1 WRITE LED PORTS

The “WRITE LED PORTS” frame allows the user to switch the demo board LEDs (LED1 to LED4, respectively) ON or OFF (see *Figure 8*).

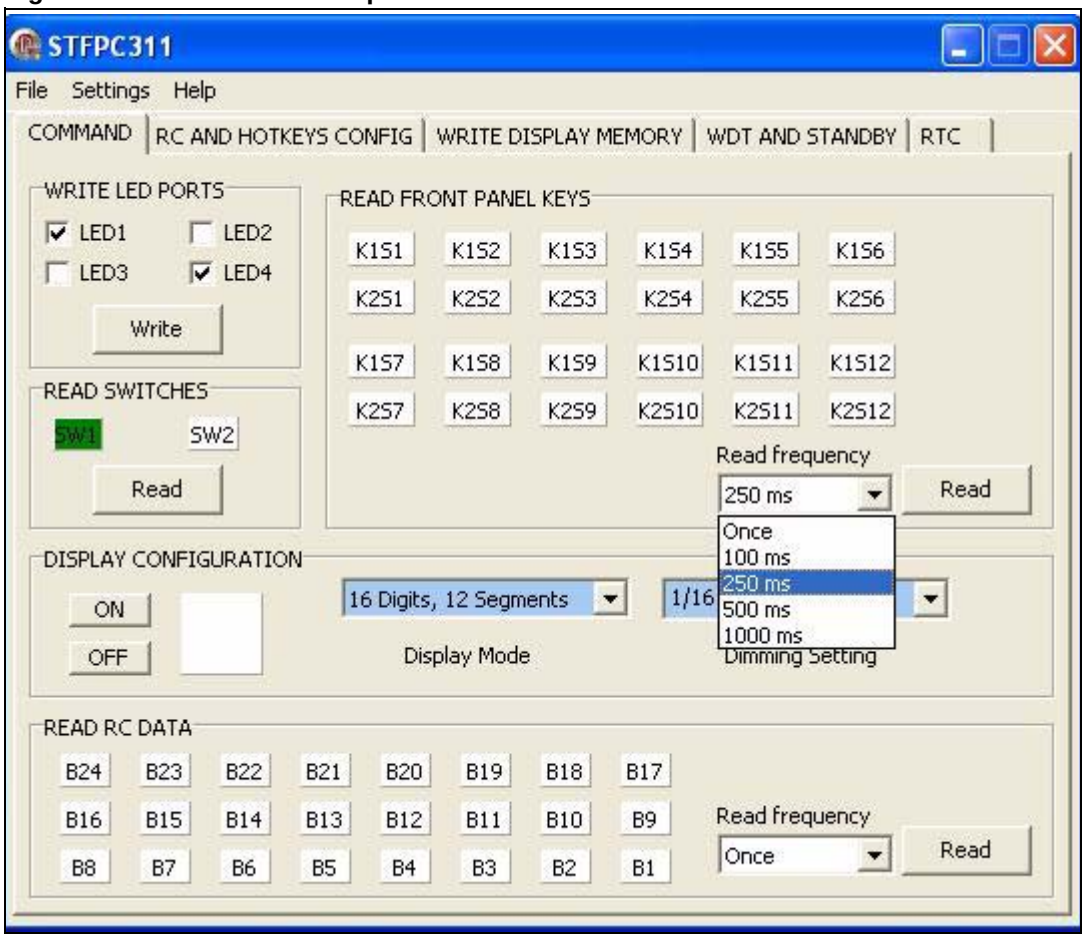
2.4.2 READ SWITCHES

Clicking on the “READ SWITCHES” button allows the user to read the status of the demo board switches (SW1 and SW2, see *Figure 8*).

2.4.3 Setting the READ Frequency

One can select the time period after which the status of the Front Panel keys is to be read. The same option is also available for READ RC DATA (see *Figure 8*) and RTC STATUS (see *Figure 10 on page 13*).

Figure 8. Command Tab Options



2.5 RC and HOTKEYS CONFIG Tab

2.5.1 Selecting the Remote Control Protocol

The STFPC311 supports three Remote Control (RC) protocols, RC5, RC6, and NEC (see *Appendix A: Remote Control Protocols on page 14* for RC protocol details). Select the appropriate protocol using radio buttons in “REMOTE CONTROL PROTOCOL” frame on the RC AND HOTKEYS CONFIG tab (see *Figure 9 on page 12*).

The RC5 and RC6 protocols use Bi-phase modulation Manchester encoding, in which logic transitions represent a logic high or logic low signal (see *Appendix A on page 14* for details).

The NEC protocol uses pulse distance bit encoding. A logic '1' takes 2.25ms to transmit, while a logic '0' takes only 1.12ms. A message is started by a 9ms Auto Gain Control (AGC) burst, which is followed by a 4.5ms space, which is then followed by the Address and Command.

The Address and Command are transmitted twice. The second time, all of the bits are inverted and can be used for verification of the received message.

2.5.2 Device Address Setting

The STFPC311 needs to be configured with the address of the Remote Control with which it is intended to be interfaced. Specify the address of the Remote Control in the text box in the “RC ADDRESS” frame on RC AND HOTKEYS CONFIG tab (see *Figure 9*). For example, the address for the RC5 protocol is 0x00 (see *Table 1*).

2.5.3 RC Hot Key Configuration

The STFPC311 GUI supports 24 Front Panel keys, 8 of which may be programmed as RC hot keys using check boxes in the “RC HOTKEYS CONFIGURATION” frame on RC AND HOTKEYS CONFIG tab in *Figure 9* (see *Appendix A on page 14*). For example, the RC hot key configuration for STANDBY for the RC5 protocol is 0x0C (see *Table 1*).

Table 1. RC Protocol Address and STANDBY RC Hot Key

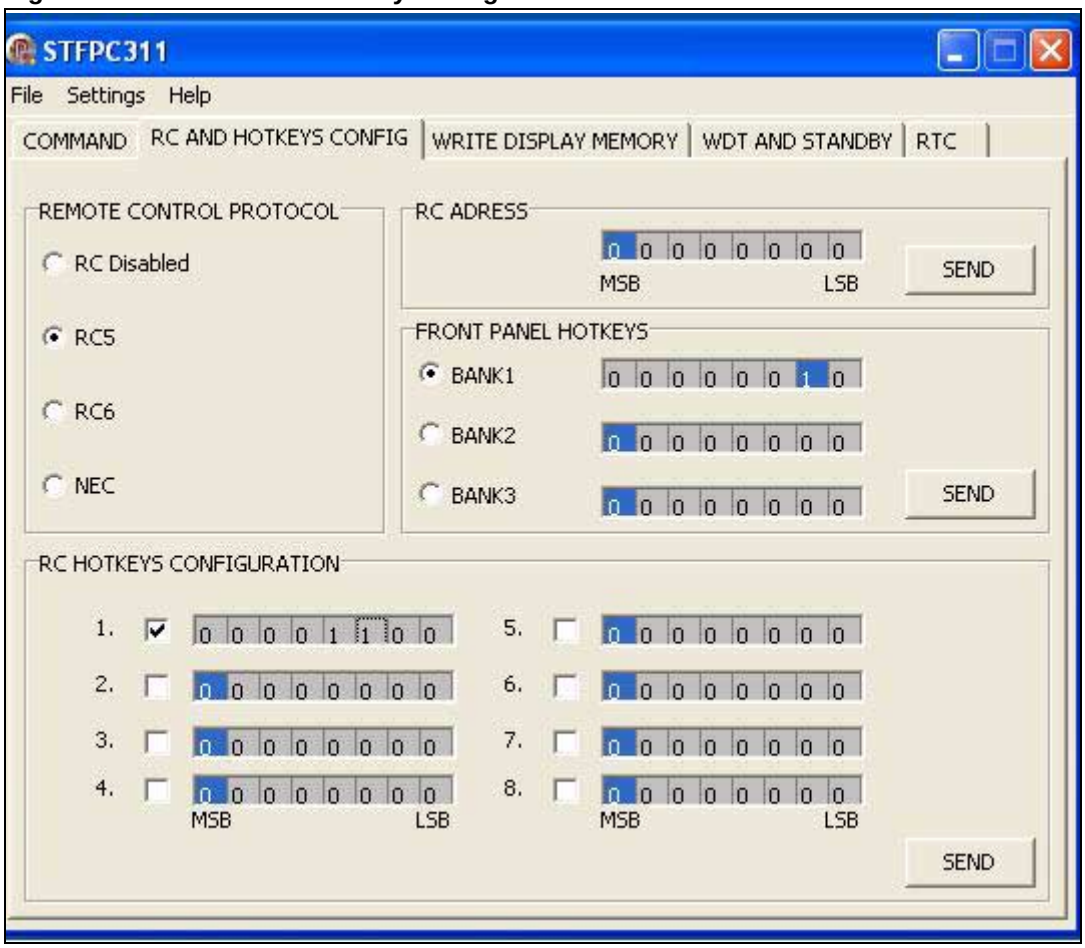
Protocol	Address(1)	RC Hotkey Configuration for STANDBY
RC5	0x00	0x0C
RC6	0x27	0x0C
NEC	0x02	0x88

1. Different remotes using the same protocol may have different device addresses.

2.5.4 Front Panel Hotkeys

The “FRONT PANEL HOTKEYS” frame on the RC AND HOTKEYS CONFIG tab in *Figure 9* shows the settings used to configure the KS1/K2 key as a hot key (see *Appendix B: Front Panel Key Banks on page 23* for more Front Panel key details).

Figure 9. Front Panel Hot Key Configuration - as STANDBY



2.5.5 STANDBY and Wake-up Sequence

- To put the VFD controller in STANDBY mode, choose the “READY LOW” option in the “STANDBY CONTROL” frame on the WDT AND STANDBY tab.
- When the VFD controller is in STANDBY mode, there are two ways to wake-up the controller:
  a) pressing the remote control STANDBY key, and
  b) pressing the Front Panel Hotkey.
- After the controller wakes up from STANDBY mode choose the “READY HIGH” option in the “STANDBY CONTROL” frame on the WDT AND STANDBY tab within 10 seconds, otherwise, the controller will go into STANDBY mode again.

The decoded IR commands are passed on to the main processor through the serial interface by sending 3 bytes of data. Labels in “READ RC DATA” frame on COMMAND tab represents the 24 bits of these 3-byte data frames.

2.6 RTC Tab

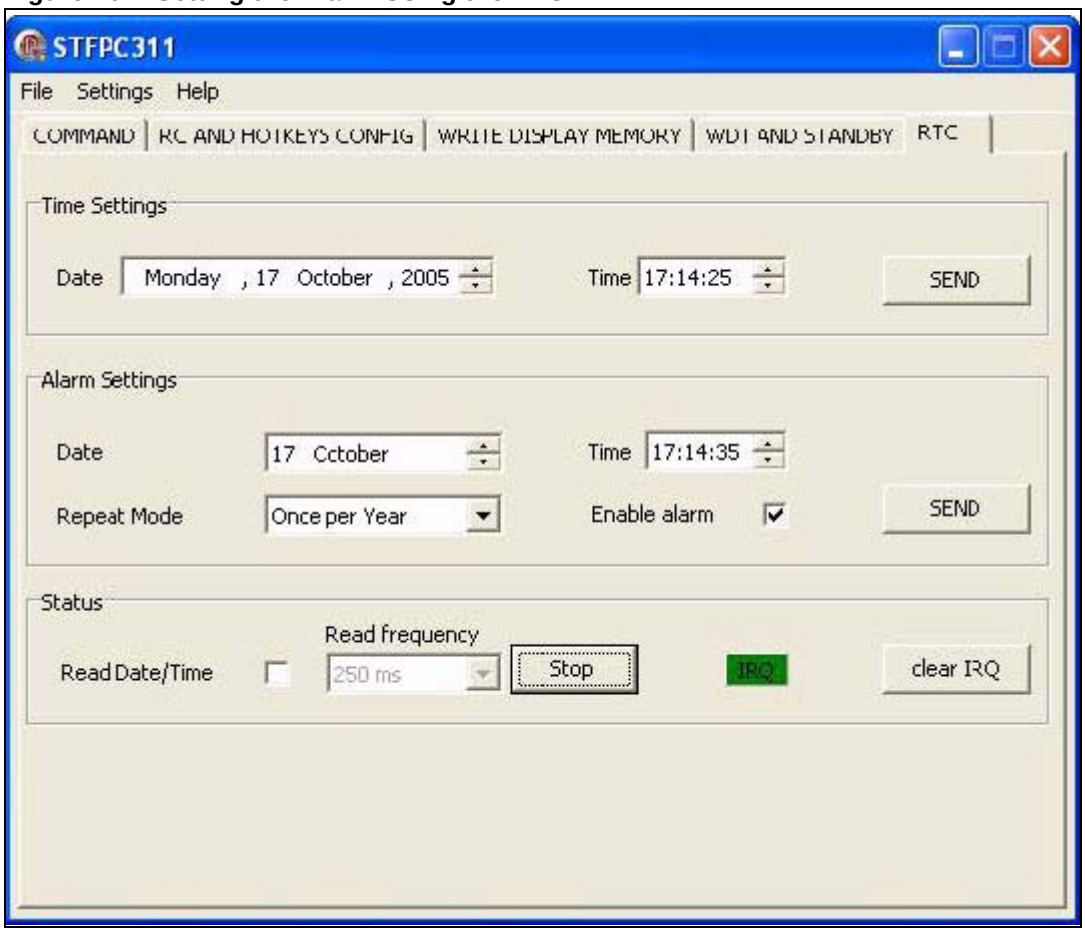
The “Time Settings” frame shows the current system date and time, but these can also be configured by the user as well. To configure the date and time at which the RTC interrupt is to be generated (see *Figure 10*):

1. Set the date and time in the “Alarm Settings” frame.
2. Specify the frequency at which the RTC interrupt status is to be read using the “Read Frequency” pull-down menu in the “Status” frame.

Note: The color of IRQ label changes to green when the RTC interrupt is generated.

Note: If “Read Date/Time” check box is selected, the Time display in “Time Settings” frame follows system time.

Figure 10. Setting the Alarm Using the RTC



Appendix A Remote Control Protocols

A.1 RC5 Protocol Key Interpretation

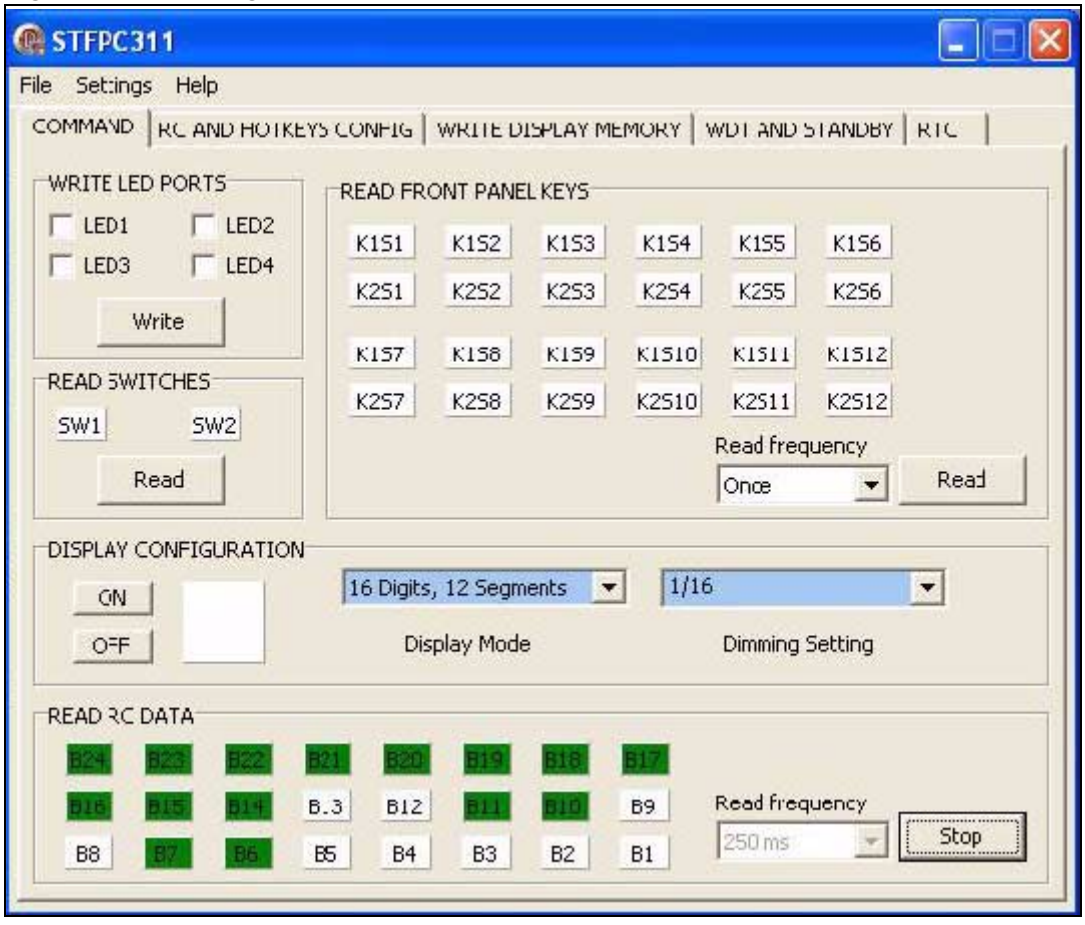
Figure 11 shows the value in the 3-byte data frame when the RC5 remote control STANDBY key is pressed.

The RC key interpretation of these bit values for the 3-byte data frames for the various STFPC311 protocols is as follows:

- B1 to B5: Device Address
- B6: Start bit
- B7: Toggle bit
- B8-B15: Key Code Data
- B16-B24: Stuffed bits (ignored)

Note: See RC and HOTKEYS CONFIG Tab on page 11 for protocol information.

Figure 11. Reading the RC5 STANDBY Data



A.2 RC5 Hot Key Configuration

Figure 12 shows the STFPC311 being configured to interface with the RC5 protocol-based remote control.

The RC5 hot key addressing for STANDBY configuration is as follows:

- RC Address: 0x00
- Hot Key: STANDBY (code: 0x0C)

The RC5 protocol uses Bi-phase modulation Manchester encoding in which a low-to-high transition represents a logic high signal, and a high-to-low transition represents a logic low signal.

Note: See RC and HOTKEYS CONFIG Tab on page 11 for protocol information.

Figure 12. RC5-based Remote Control STANDBY Configuration

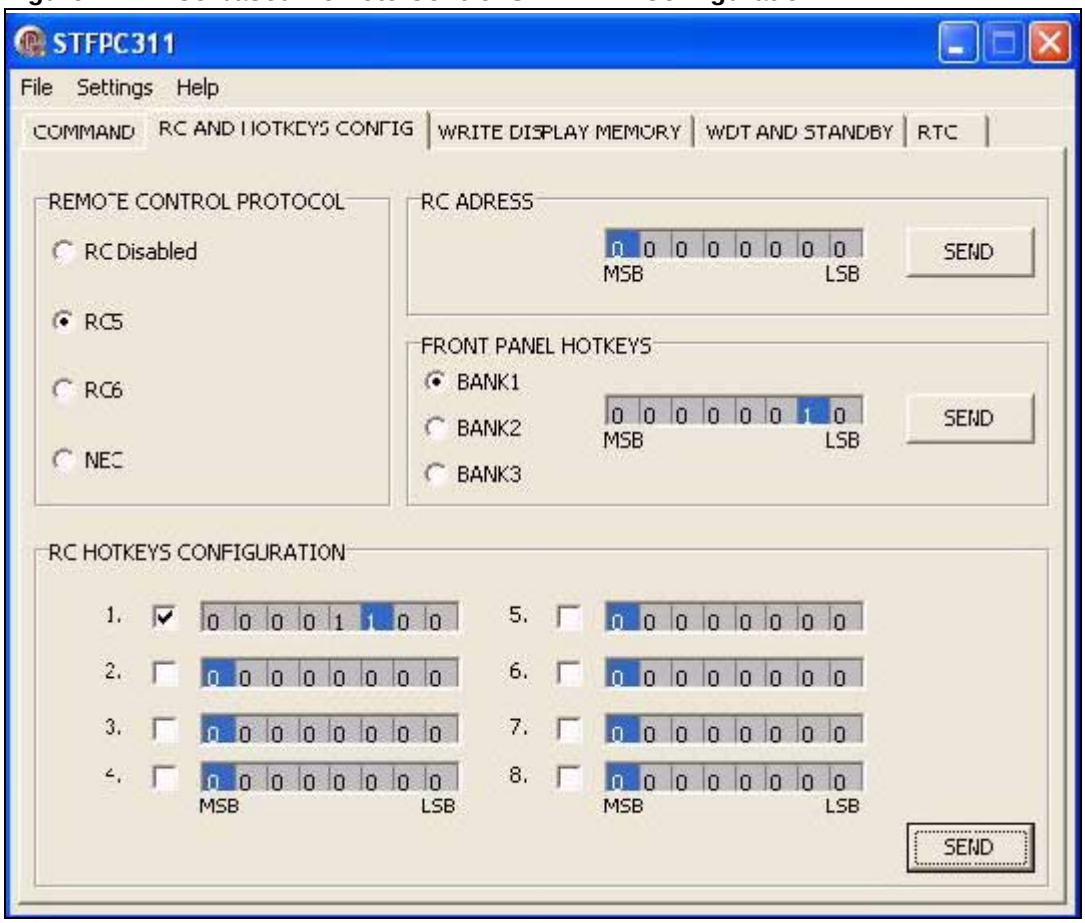
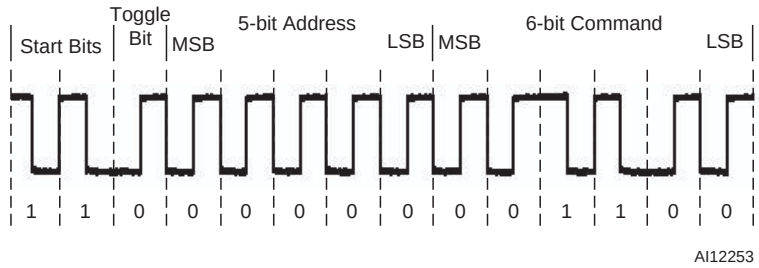


Figure 13 shows the signal at the IR sensor output when the RC5 STANDBY key is pressed. The output shown is an inversion of the IR signal received by the IR sensor.

Figure 13. RC5 Protocol STANDBY Key Waveforms



A.3 RC6 Protocol Key Interpretation

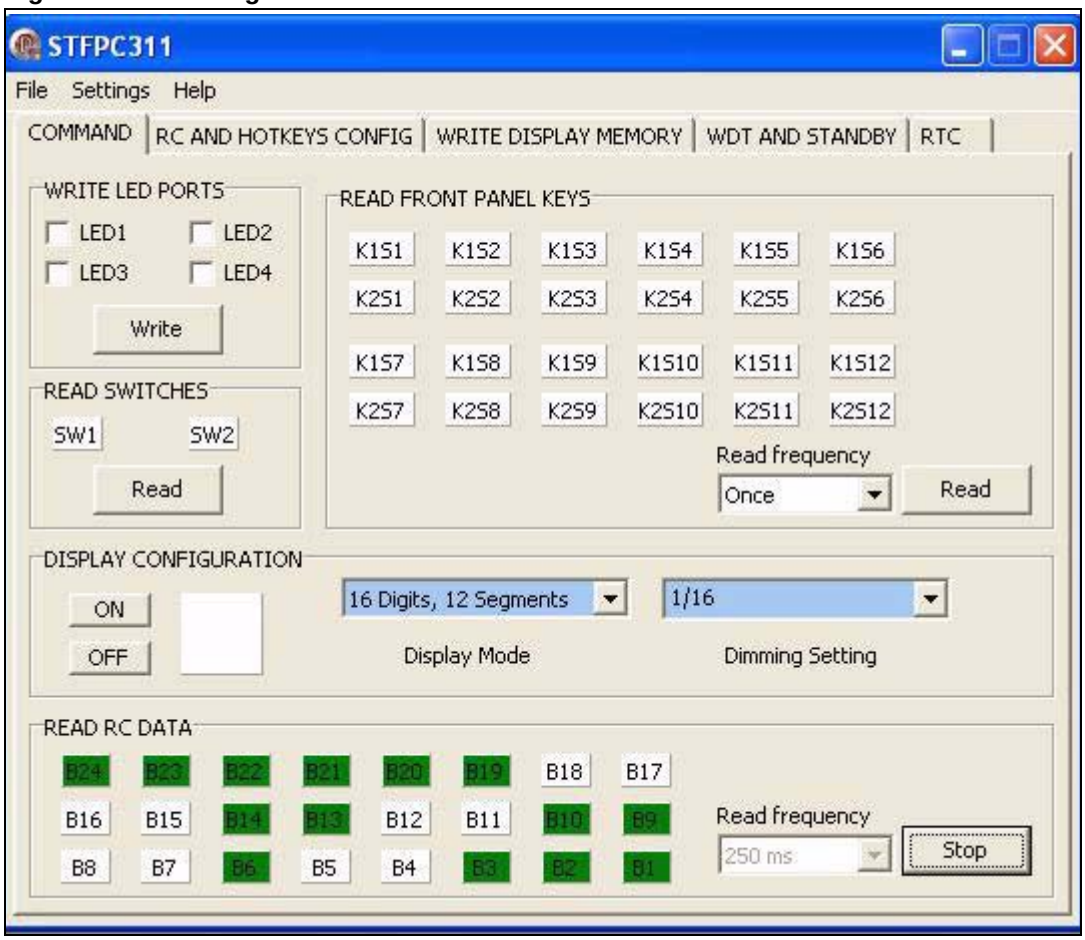
Figure 14 shows the signal at the output of IR sensor when STANDBY key of RC6 remote control is pressed.

The RC key interpretation of these bit values for the 3-byte data frames for the various STFPC311 protocols is as follows:

- B1-B8: Device Address
- B9: Start bit
- B10: Toggle bit
- B11-B18: Key Code Data
- B19-B24: Stuffed bits (ignored)

Note: See RC and HOTKEYS CONFIG Tab on page 11 for protocol information.

Figure 14. Reading the RC6 STANDBY Data



A.4 RC6 Hot Key Configuration

Figure 15 shows STFPC311 being configured to interface with the RC6 protocol-based remote control.

The RC6 hot key addressing for the STANDBY configuration is as follows:

- RC Address: 0x27
- Hot Key: STANDBY (code: 0x0C)

The RC6 protocol uses Bi-phase modulation Manchester encoding in which a low-to-high transition represents a logic low signal and a high-to-low transition represents a logic high signal.

Note: These transitions are the **opposite** of those in the RC5 protocol.

Note: See RC and HOTKEYS CONFIG Tab on page 11 for protocol information.

Figure 15. RC6-based Remote Control STANDBY Configuration

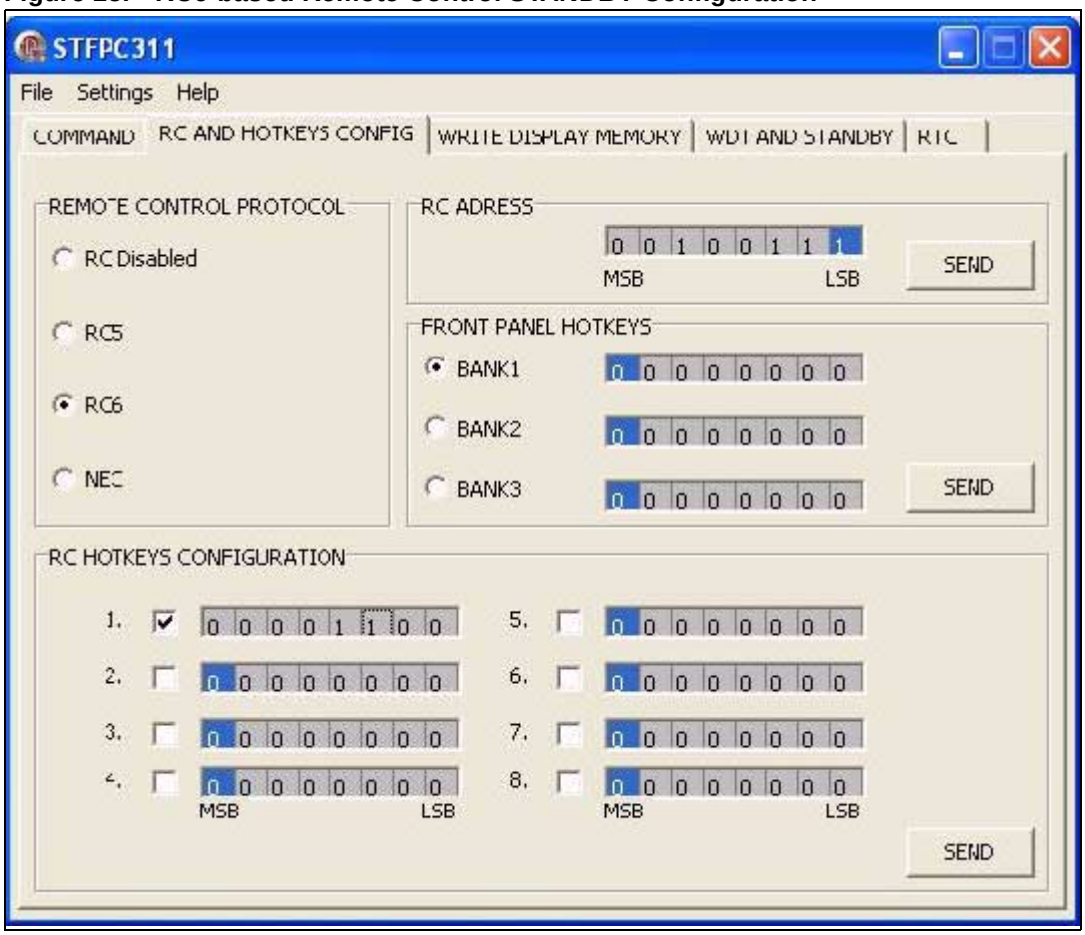
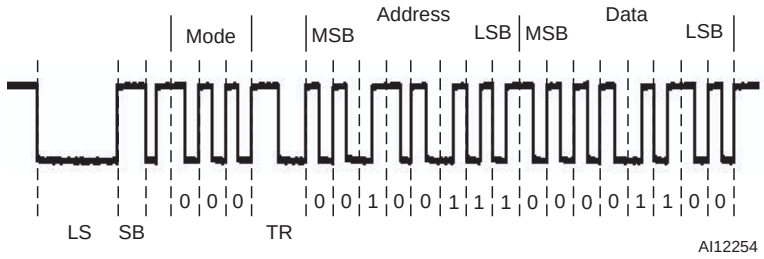


Figure 16 shows the signal at the IR sensor output when the RC6 STANDBY key is pressed. The output shown is an inversion of the IR signal received by the IR sensor.

Figure 16. RC6 Protocol STANDBY Key Waveforms



Notes:

1. LS: Leader Start Pulse
2. SB: Start Bit
3. TR: Trailer Bit

A.5 NEC Protocol Key Interpretation

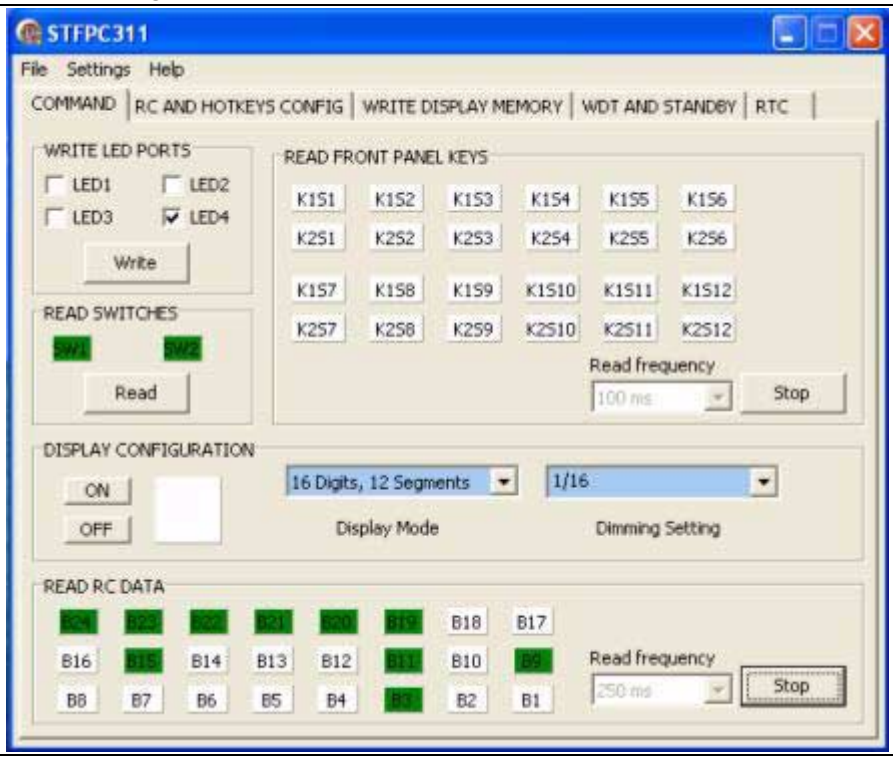
Figure 17 shows the value in 3 byte data frame when KEY1 of NEC remote is pressed.

The RC key interpretation of these bit values for the 3-byte data frames for the various STFPC311 protocols is as follows:

- B1-B8: Device Address
- B9: Start bit
- B10: Toggle bit
- B11-B18: Key Code Data
- B19-B24: Stuffed bits (ignored)

Note: See RC and HOTKEYS CONFIG Tab on page 11 for protocol information.

Figure 17. Reading the NEC Remote Control KEY1 Data



A.6 NEC Hot Key Configuration

Figure 18 shows STFPC311 being configured to interface with NEC protocol-based remote control.

The NEC hot key addressing for the KEY1 configuration is as follows:

- RC Address: 0x02
- Hot Key: KEY1 (code: 0x88)

A command is transmitted only once, even when the key on the remote control remains pressed. Every 110ms, a repeat code is transmitted for as long as the key remains down. This repeat code is simply a 9ms AGC burst, followed by a 2.25ms space and a 560µs burst.

Note: See RC and HOTKEYS CONFIG Tab on page 11 for protocol information.

Figure 18. NEC-based Remote Control KEY1 Configuration

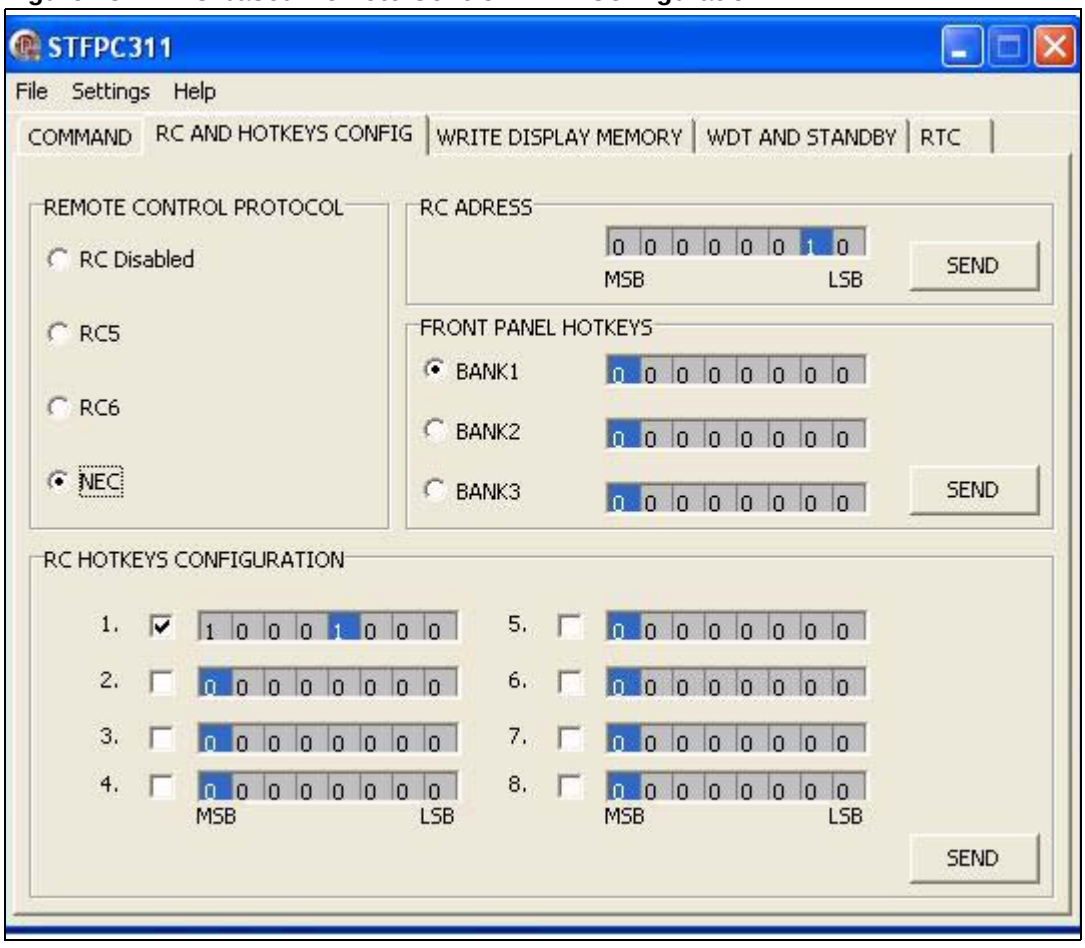
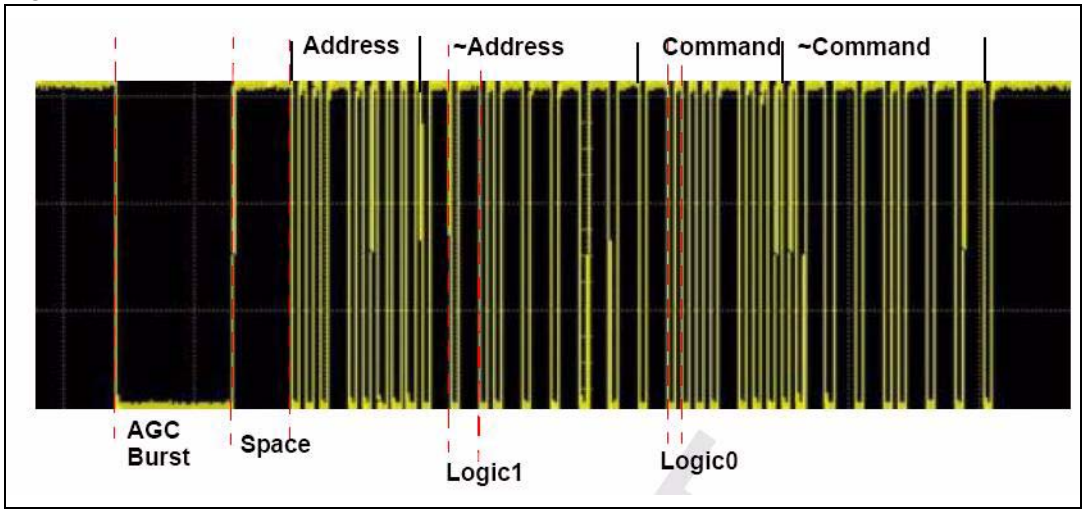


Figure 19 shows the signal at the IR sensor output when the NEC remote control KEY1 is pressed. The output shown is an inversion of the IR signal received by the IR sensor.

Figure 19. NEC Protocol KEY1 Code Waveforms



Appendix B Front Panel Key Banks

STFPC311 has key data memory of size 2x12, which means it can support up to 24 Front Panel keys. These keys are divided into 3 banks of 8 keys each.

To establish relationship between the keys on board and key labels in the “READ FRONT PANEL KEYS” frame on the Command tab, replace occurrences of “S” by “KS”. For example, Key label “K2S12” corresponds to the KS12/K2 Key on the evaluation board.

In *Figure 20*, *Figure 21*, and *Figure 22*, the keys in the color “Blue” represent the keys available on the STFPC311 evaluation board.

Note: Only 8 keys out of 24 keys are programmable as hot keys. Only one bank of 8 keys can be used at one time as hot keys.

Figure 20. Bank1 Keys

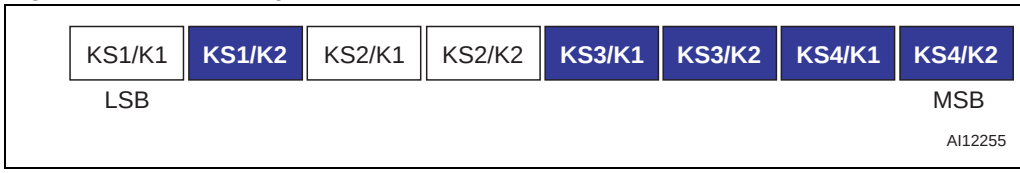


Figure 21. Bank2 Keys

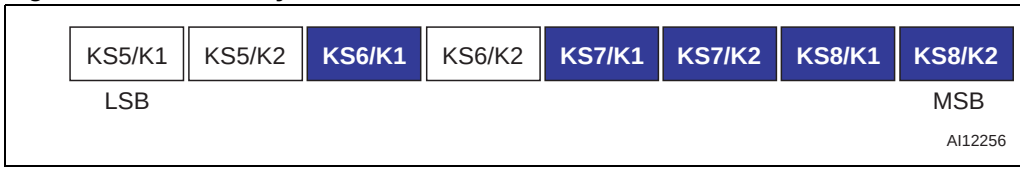
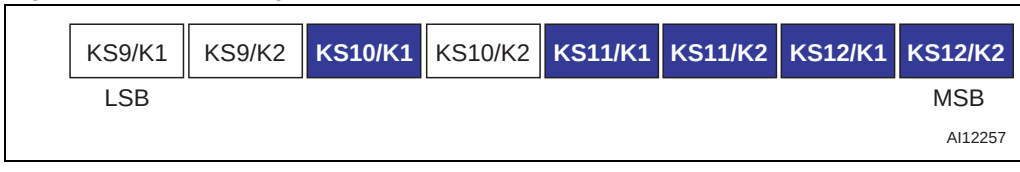


Figure 22. Bank3 Keys



3 Revision History

Table 2. Document Revision History

Date	Revision	Changes
21-Mar-2006	1	Initial release.

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