

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.





Rev 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*).

STFPC311								
File Settings Help								
COMMAND RC AND HOTKEYS CONFIG	WRITE DISPLAY MEMORY WDT AND STANDBY RTC							
WR LPTx Setting	NT PANEL KEYS							
Parallel Port 0x 0378	K152 K153 K154 K155 K156							
OK Cancel	K252 K253 K254 K255 K256							
	K158 K159 K1510 K1511 K1512							
READ SWITCHES K257	K258 K259 K2510 K2511 K2512							
5W1 5W2	Read frequency							
Read	Once 💌 Read							
DISPLAY CONFIGURATION								
ON 11 Digits	, 17 Segments 💌 1/16 💌							
Dis	play Mode Dimming Setting							
READ RC DATA								
B24 B23 B22 B21 B20	B19 B18 B17							
B16 B15 B14 B13 B12	B11 B10 B9 Read frequency							
<u>B8</u> B7 B6 B5 B4	B3 B2 B1 Once Read							

Figure 4. Configure Parallel Port

Figure 5.	READY HIGH Selection
-----------	-----------------------------

@ STFPC311	
File Settings Help	
COMMAND RC AND HOTKEYS CONFIG	WRITE DISPLAY MEMORY WDT AND STANDBY RTC
	WATCHDOG ACTION SETTING
Timer Setting	C No Action
10 seconds 💌	
The second se	Issue STANDBY
Reset Timer	
STANDBY CONTROL	
C READY LOW	
READY HIGH	



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

C STFPC311				
File Settings Help				
COMMAND RC AND HOTKE	YS CONFIG WRITE DI	SPLAY MEMORY	WUT AND STANDBY	RIC
WRITE LED PORTS		L KEYS		
LED1 LED2	K151 K152	K153 K154	K155 K156	
Write	K251 K252	K253 K254	K255 K256	
	K157 K158	K159 K1510	КІБІІ КІБІД	
READ SWITCHES	K257 K258	K259 K2510	K2511 K2512	
<u>5W1</u> <u>5W2</u>			Read frequency	
Read			Once 💽	Read
	11 Digits, 17 Segm Display Mode	ents 💌 [11]	Dirming Setting	•
READ RC DATA		a sup over an		
B24 B23 B22	B21 B20 B19	B18 B17		
B16 B15 B14	B.3 BIZ BII	B10 B9	Read frequency	
B8 B7 B6	B5 B4 B3	B2 B1	Once	Read



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*).



Dis	play	: Me	emo 3	ry 4	5	6	7	8	9	10	11	12	13	14	15	16	17	e.	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	0	GRID	
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	0		
3	n	Π	Π	Π	Π	Π	Π	Π	n	n	Π	n	Π	Π	ſ c	Π	n		
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C c	0	0		
5	0	0	0	0	1	1	1	1	1	0	0	0	1	0	L c	0	0		
7	1	0	0	0	1	1	1	1	1	1	0	0	1	0	L C	0	0		
2	1	0	0	0	1	1	1	1	0	1	0	0	1	0	c	0	0	Sat Bite	Dlay -
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	C	0	0	Jet Dits	Decet
10	lo	õ	õ	0	0	0	0	õ	0	0	0	0	0	0	C	0	ō		Play
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	c	0	ō		Stop
									166.0		16ka			1860	<u>Inde</u>				Open Pause Close



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*).

@ STFPC311							
File Settings Help							
COMMAND RC AND HOTKEYS	CONFIG WRITE DISPLAY MEMORY	VDT AND STANDBY RTC					
WRITE LED PORTS	READ FRONT PANEL KEYS K151 K152 K153 K154	K155 K156					
11144	K251 K252 K253 K254	K255 K256					
write	K157 K158 K159 K1510	K1511 K1512					
READ SWITCHES	K257 K258 K259 K2510	K2511 K2512					
SW2	Read frequency						
Read		250 ms 💌 Read					
DISPLAY CONFIGURATION		Once 100 ms					
OFF	16 Digits, 12 Segments 💌 1/16 Display Mode	250 ms 500 ms 1000 ms Dimming Setting					
READ RC DATA							
B24 B23 B22 B2	1 <u>B20</u> <u>B19</u> <u>B18</u> <u>B17</u>						
B16 B15 B14 B1	3 B12 B11 B10 B9	Read frequency					
B8 B7 B6 B5	5 B4 B3 B2 B1	Once					
		S,					

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*).

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

 Table 1.
 RC Protocol Address and STANDBY RC Hot Key

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

STFPC311				
File Settings Help	14			
COMMAND RC AND HOTKEYS CON	FIG WRITE DISPLA	Y MEMORY WDT AND STANDBY	RTC	
REMOTE CONTROL PROTOCOL	RC ADRESS	000000000 MSB LSB	SEND	
€ RC5	FRONT PANEL H	IOTKEYS		
C RC6	BANK1 BANK2 BANK3	0 0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0		
RC HOTKEYS CONFIGURATION				
1. 🔽 🛛 🗤 🗤 🗤	1 ₀₀ 5. Г	0000000		
2. 🔽 👩 0 0 0 0	0 0 6. Г	0000000		
3. 🗆 0 0 0 0 0	0 0 7. Г			
4.	0 0 8. T	0 0 0 0 0 0 0 0 MSB LSB		
			SEND	

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.

C STFPC311				
File Settings Help				
COMMAND RC AND HOTKEYS CON	-IG WRITE DIS	PLAY MEMORY WL	TAND STANDBY	RTC
The Falls				
Time Settings				
Date Monday , 17 October	, 2005 ÷	Time 17:14:25	-	SEND
		0.4		
Alarm Settings				
riidini sotuligo				
Date 17 Cctobe	1	Time 17:14:35	5 🕂	
Repeat Mode Once per Ve	ar 🔻	Enable alarm		SEND
	and a second			
Status	Allowed Cold Market			
Read	requency			t
Read Date/Time 🔽 250 r	15 <u>- </u>	Stop	180	clear RQ

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

STFPC311						
File Settings Help						
COMMAND RC AND HUTKEY	S CONFIG WRITE	DISPLAY M	EMORY	WD1 AND S		RIC
WRITE LED PORTS						
LED1 LED2	K151 K152	K153	K154	K155	K156	
Write	K251 K252	K253	K254	K255	K256	
	K157 K158	K159	K1510	K1511	K1512	
READ SWITCHES	K257 K258	K259	K2510	K2511	K2512	
<u>5W1</u> 5W2				Read freq	uency	
Read				Once	<u> </u>	Read
DISPLAY CONFIGURATION	16 Digits, 12 Sec Display Mo	gments 👱	1/16	i Dimming :	Setting	•
READ RC DATA	821 820 819 3.3 812 811 85 84 83	B2	B17 B9 B1	Read freq	uency	Stop
READ RC DATA	821 B221 B19 5.3 B12 B11 B5 B4 B3	B18 D10 B2	8177 69 81	Read freq	uency	Stop

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

R STFPC311		
File Settings Help		
COMMAND RC AND HOTKEYS CONF	IG WRITE DISPLAY MEMORY WDT AND STANDBY I	
C RC6	FRONT PANEL HOTKEYS FRONT PA	SEND
RC HOTKEYS CONFIGURATION 1. ✓ 0 0 0 1 1 2. ✓ 0 0 0 0 0 0 0 3. ✓ 0 0 0 0 0 0 0 0 4. ✓ 0 0 0 0 0 0 0 MSB <	0 0 5. 0	SEND

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.







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

🕼 STFPC311						
File Settings Help						
COMMAND RC AND HOTKEY	S CONFIG WRITE	E DISPLAY ME	EMORY V	VDT AND S	TANDBY	RTC
WRITE LED PORTS		NEL KEYS				
LED1 LED2	<u>K151</u> K152	K153	K154	K155	K156	
Write	K251 K252	к253	K254	K255	K256	
	K157 K158	K159	K1510	K1511	K1512	
SW1 SW2	K257 K258	K259	K2510	K2511	K2512	
511 5112				Read freq	uency	
Read				Once	· ·	Read
DISPLAY CONFIGURATION						
ON	16 Digits, 12 Se	gments 🖉	1/16			•
	Display M	ode		Dimming S	Setting	
READ RC DATA						
B24 B23 B22 B	21 B20 B19	B18	B17			
B16 B15 B14	B12 B11	<u>B10</u>	89	Read freq		Shop
B8 B7 B6 H	85 B4 B3	82	81	250 ms	<u>_</u>	stop

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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

R STFPC311			
File Settings Help			
COMMAND RC AND HOTKEYS CONFI REMOTE CONTROL PROTOCOL	G WRITE DISPLAY	MEMORY WDI AND STANDBY	SEND
C RCS RCS C NEC	FRONT PANEL HC G BANK1 G BANK2 G BANK3	OTKEYS	SEND
RC HOTKEYS CONFIGURATION 1. ✓ 0 0 0 1 1 2. □ 0 0 0 0 0 0 3. □ 0 0 0 0 0 0 0 4. □ 0 0 0 0 0 0 0 MSB □ 0 0 0 0 0 0 0	0 0 5, 0 0 6, 0 0 7, 0 0 8, LSB	0 MSB LSB	SEND

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.





Notes:

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



Note:

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)

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

🕼 STFPC311			
File Settings Help			
COMMAND RC AND HOTKEYS CONF	IG WRITE DISPLA	Y MEMORY WDT AND STANDBY	RTC
C RC Disabled	RC ADRESS	0 0 0 0 0 0 1 0 MSB LSB	SEND
C RC5	FRONT PANEL H	OTKEYS	
© RC6	 BANK1 BANK2 BANK3 		SEND
RC HOTKEYS CONFIGURATION			
1. 🔽 1 0 0 1 0	0 0 5. Г	0 0 0 0 0 0 0	
2. 🗖 0 0 0 0 0	0 0 6.	0 0 0 0 0 0 0 0	
3. 🗖 🗖 0 0 0 0 0	00 7. 🗆	0 0 0 0 0 0 0	
4. 🗖 0 0 0 0 0 0 0 MSB	0 0 8. F	0 0 0 0 0 0 0 0 MSB LSB	
			SEND



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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

KS1/K1	KS1/K2	KS2/K1	KS2/K2	KS3/K1	KS3/K2	KS4/K1	KS4/K2
LSB							MSB
							AI12255

Figure 21. Bank2 Keys

KS5/K1	KS5/K2	KS6/K1	KS6/K2	KS7/K1	KS7/K2	KS8/K1	KS8/K2
LSB							MSB
							AI12256

Figure 22. Bank3 Keys

KS9/K1	KS9/K2	KS10/K1	KS10/K2	KS11/K1	KS11/K2	KS12/K1	KS12/K2
LSB							MSB
							AI12257



3 Revision History

Table 2.Document Revision History

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



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