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Team Engineering

TE5100 PCI/PXI 100 MHz Signal Generator

Programming Manual

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1 Introduction

The TE5100 is a PC plug in board based 100 MHz digitally synthesized sine wave generator. One to four TE5100 plug in boards may be deployed in the same PC and are controlled through a single Windows dynamic link library (DLL). The DLL is called Te5100sg.dll and provides the interface between the hardware and the end-user's application program.

As an alternative to writing custom code, a simple Windows Graphical User Interface (GUI) is provided as well which may be used for interactive control of one to four TE5100 signal boards.

This programming manual describes the functions contain in the Te5100sg.dll and the function declarations. Samples are provided for calling the DLL from Visual Basic.

2 DLL Configuration File

Each time the DLL is initiated, it looks for a configuration settings file located in the Windows directory. This file is called te5100.ini and contains the following information and formatting:

```
[board_settings]
base0 = 0
PLL_Multiplier0 = 10
Base1 = 8
PLL_Multiplier1 = 10
Base2 = 16
PLL_Multiplier2 = 10
Base3 = 24
PLL_Multiplier3 = 10
```

Values shown here are defaults and will be used if one or more entries or the entire ini file is omitted. Base numbers correspond to board ID's, thus base0=0 indicates that the board with ID 0 will be the first board found. Offset values may be assigned to the four boards as desired as long as there are no duplicates and the values are 8 apart. For most situations, there is no need to set the base values and the defaults may be used.

The PLL_Multiplier entries set the default initialization values for the internal PLL multiplier of each board. Ten is the default and the recommended value for the TE5100.

A unique board ID number ranging from 0 to 3 identifies each board. Every function or procedure call in the DLL has a board ID parameter. It is always a 32-bit integer type. (**long** in VB)

3 Constant Declarations

The following constants may be useful when developing application programs for the TE5100 board.

```
BNC_FSK = 0;          // BNC source is FSK input
BNC_EXT = 1;          // BNC source is Ext clock
// Operating modes
MODE_SINGLE = 0;
MODE_FSK = 1;
MODE_RAMP = 2;
MODE_CHIRP = 3;
MODE_BPSK = 4;
OUTPUT_ON = 1;
OUTPUT_OFF = 0;
//AD9854 DDS limits
INT_FREQ = 28147497.6710656;
PHASE_RES = 45;
PLL_MAX = 20;
PLL_MIN = 4;
PLL_BYPASS = 1;
DAC_MAX = 4095;
DAC_MIN = 0;
VRMS_MAX = 1;
VRMS_MIN = 0;
```

4 DLL Functions and Procedures

The following functions and procedures are provided by the DLL:

General System functions

- te51_DLLVersion
- te51_BoardPresent
- te51_Model_Number
- te51_xWaitFor
- te51_Initialize_DDS

Output Control functions

- te51_BNC_Select
- te51_Set_PLL_Multiplier
- te51_Write_Frequency
- te51_Write_Phase
- te51_Write_RampRateClock
- te51_Output_Power
- te51_Set_Function
- te51_Set_DAC
- te51_Program_DAC_VRMS

Low Level DSS access:

- te51_Write_REG
- te51_Read_REG

4.1 te51_DLLVersion

te51_DLLVersion(iBrdID:integer; Var strRevision:PChar):integer;

This function returns a version string as a null terminated string. This version string is passed by reference and is the second parameter in the function list. The board ID must be passed by value as the first parameter. The function result returns a 32-bit integer (int32), which contains the DLL version multiplied by 100. Thus, version 1.00 would be returned at 100.

Future versions of the DLL may contain additional functions. By having the ability to determine the DLL version, your application program can be designed to handle new features only when available.

4.2 te51_BoardPresent

function te51_BoardPresent(iBrdID:integer):integer;

This function returns 0 is the board with the board ID passed as the first and only parameter is not present. If the board is present, a -1 is returned instead. The function type is a 32-bit integer (int32).

This function must be used any time a new device is being accessed to make sure a handle to the board is available. If a board is not present and access to that board is attempted using any of the other DLL functions (except the te51_DLLVersion call), a run-time error will occur.

4.3 te51_Model_Number

te51_Model_Number(iBrdID:integer):integer;

This function returns the model number for the board ID specified as the first and only parameter. The board model for a TE5100 is $5100 (hex) or 20736 decimal.

4.4 te51_xWaitFor

procedure te51_xWaitFor(period:integer);

This procedure generates a time delay specified in milliseconds. The resolution and accuracy of this function is about 1 millisecond for times under 2 seconds. Times above 2 seconds (2000 msec) will result in relinquishing control to other windows applications, which may affect accuracy. The time to delay for is specified as a 32-bit integer (int32). The function result for this call is void.

4.5 te51_Initialize_DDS

procedure te51_Initialize_DDS(iBrdID:integer);

This call initializes the TE5100 signal generator board to its factory default setting. This should always be the first function called in any application program before attempting to program the board. The only parameter passed this call is the board ID. The function result for this call is void.

4.6 te51_BNC_Select

procedure te51_BNC_Select(iBrdId:integer; iMode:integer);

This calls switches the BNC connector between external clock input and FSK control modes. Valid mode values are:

BNC_FSK = 0; // BNC source is FSK input

BNC_EXT = 1; // BNC source is Ext clock

4.7 te51_Set_PLL_Multiplier

function te51_Set_PLL_Multiplier(iBrdID:integer; iMultiplierValue:integer):integer;

This function sets the PLL multiplier value for the internal clock generator. Valid multiplier values are:

PLL_MAX = 20;

PLL_MIN = 4;

PLL_BYPASS = 1;

Values outside these will result in an error code of –328, Invalid PLL multiplier value.

4.8 te51_Write_Frequency

function te51_Write_Frequency(iBrdID:integer; iIndex:integer; iFreq:Int64):integer;

This function call sets the selected (iIndex) frequency to the value specified by iFreq. Valid iIndex values are:

1 Frequency 1

2 Frequency 2

3 Delta Frequency

If an index value outside this range is passed, a -222, "Data out of range" error will be returned. If the function completes successfully, the error result will be zero. Note that the frequency value is passed as 64-bit integer (not available in VB).

This function automatically accounts for the value of the PLL multiplier.

4.9 te51_Write_Phase

function te51_Write_Phase(iBrdID:integer; iIndex:integer; dblPhase:double):integer;

This function call sets the selected (iIndex) phase to the value specified by dblPhase. Valid iIndex values are:

1 Phase of Frequency 1

2 Phase Frequency 2

If an index value outside this range is passed, a -222, "Data out of range" error will be returned. If the function completes successfully, the error result will be zero. Note that the phase value is passed as 64-bit IEEE floating point value between 0.0 and 360.0 (Double in VB).

4.10 te51_Write_RampRateClock

function te51_Write_RampRateClock(iBrdID:integer; iRampRate:Integer):integer;

This function sets the ramp rate for swept frequency output. The ramp rate is a value between 0 and $100000 (hex) or 1048576 decimal. If a value outside this range is passed, a -222, "Data out of range" error will be returned. If the function completes successfully, the error result will be zero.

4.11 te51_Output_Power

procedure te51_Output_Power(iBrdID:integer; iMode:integer);

This call toggles the output of the TE5100 signal generator board on or off depending on the value of the iMode parameter. Valid values for the mode parameter are:

OUTPUT_ON = 1;

OUTPUT_OFF = 0;

4.12 te51_Set_Function

function te51_Set_Function(iBrdID:integer; iMode:integer):integer;

This function sets the basic operation mode of the TE5100 signal generator board depending on the value of the iMode parameter. Valid values for the mode parameter are:

MODE_SINGLE = 0;

MODE_FSK = 1;

MODE_RAMP = 2;

MODE_CHIRP = 3;

MODE_BPSK = 4;

If a value outside this range is passed, a -222, “Data out of range” error will be returned. If the function completes successfully, the error result will be zero.

4.13 te51_Set_DAC

function te51_Set_DAC(iBrdID:integer; iAmplitude:integer):integer;

This functions sets the amplitude of the TE5100 signal generator board to the value passed in the iAmplitude parameter.. Valid values for the mode parameter are between:

DAC_MAX = 4095;

DAC_MIN = 0;

Full scale DAC output corresponds to a 1.0 Vrms output. When terminated at 50 Ohms, the output value will be 0.500 Vrms for full scale DAC output.

If a value outside this range is passed, a -222, “Data out of range” error will be returned. If the function completes successfully, the error result will be zero.

Note the amplitude of the TE5100 can also be programmed directly in Vrms using the te51_Program_DAC_VRMS function call.

4.14 te51_Program_DAC_VRMS

function te51_Program_DAC_VRMS(iBrdID:integer; dblVrms:double):integer;

This functions sets the amplitude of the TE5100 signal generator board to the value passed in the dblVrms parameter.. Valid values for the mode parameter are between 0.000 and 1.000.

Full scale DAC output corresponds to a 1.0 Vrms output. When terminated at 50 Ohms, the output value will be 0.500 Vrms for full scale DAC output.

If a value outside this range is passed, a -222, “Data out of range” error will be returned. If the function completes successfully, the error result will be zero.

Note the amplitude of the TE5100 can also be programmed in bits using the te51_Program_Set_DAC function call.

4.15 te51_Write_REG

procedure te51_Write_REG(iBrdID:integer; iReg:integer; iData:integer);

This call writes a data value passed in iData to the register selected by the iReg parameter. This call provides direct access to the DDS on the TE5100 board and should be used with caution.

4.16 te51_Read_REG

function te51_Read_REG(iBrdID:integer; iReg:integer):integer;

This call reads a data value from the register selected by the iReg parameter and returns the data value as the function result. (int32 or long in VB).

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