ZT1428VXI Digitizing Oscilloscope

Introduction:

This instrument driver provides programming support for ZT1428VXI Digitizing Oscilloscope.

It contains functions for opening, configuring, taking measurements from, and closing the instrument.

Assumptions:

To successfully use this module, the following conditions must be met:

For GPIB instrument drivers:

- the instrument is connected to the GPIB.
- the GPIB address supplied to the initialize function must match the GPIB address of the instrument.

For VXI instrument drivers:

- the instrument is installed in the VXI mainframe and you are using one of the following controller options:
  - Embedded controller
  - MXI
  - MXI2
  - GPIB-VXI
- the logical address supplied to the initialize function must match the logical address of the instrument.

For RS-232 instrument drivers:

- the instrument is connected to the RS-232 interface.
- the COM port, baud rate, parity, and timeout supplied to the initialize function must match the settings of the instrument.

Error and Status Information:

Each function in this instrument driver returns a status code that either indicates success or describes an error or warning condition. Your program should examine the status code from each call to an instrument driver function to determine if an error occurred. The general meaning of the status code is as follows:

Value	Meaning
0	Success
Positive Values	Warnings
Negative Values	Errors

The description of each instrument driver function lists possible error codes and their meanings

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How To Use This Document:

Use this document as a programming reference manual.
It describes each function in the

ZT1428VXI Digitizing Oscilloscope

instrument. The functions appear in alphabetical order, with a description of the function and its C syntax, a description of each parameter, and a list of possible error codes.

Function Tree Layout:

Class/Panel Name:	Function Name:
Initialize	zt1428_init
Initialize with Options	zt1428_init_with_options
Configure	
Auto Setup	zt1428_auto_setup
Auto Logic Setup	zt1428_auto_logic
Set Vertical	zt1428_vertical
Set Acquisition	zt1428_acquisition
Set Math Function	zt1428_function
Set External Input	zt1428_ext_input
Set Outputs	zt1428_outputs
Set Edge Trigger	zt1428_edge_trigger
Advanced Trigger	
Soft Trigger	zt1428_soft_trigger
Set Trigger to Offset	zt1428_trigger_center
Set Trigger Holdoff	zt1428_trigger_holdoff
Set Pattern Trigger	zt1428_pattern_trigger
Set State Trigger	zt1428_state_trigger
Set TV Trigger	zt1428_tv_trigger
Get Trigger Event	zt1428_trigger_event
Configuration Readback	
Query Vertical	zt1428_query_vertical
Query Acquisition	zt1428_query_acquisition
Query Math Function	zt1428_query_function
Query External Input	zt1428_query_ext_input
Query Outputs	zt1428_query_outputs
Query Trigger	zt1428_query_trigger
Query Advanced Trigger	zt1428_query_adv_trigger
Query Measurement	zt1428_query_measurement
Measurement	
Get Measurement	zt1428_measurement
Advanced Measurement	
Set Measurement Level	zt1428_measurement_level
Set Delay Parameters	zt1428_delay_parameters
Set Width Parameters	zt1428_width_parameters
Set Limit Test	zt1428_limit_test
Set Mask Test	zt1428_mask_test
Get Result Statistics	zt1428_result_stats
Waveform Operations	

Digitize Waveform	zt1428_digitize_waveform
Get Digitize Complete	zt1428_dig_complete
Read Waveform to Array	zt1428_read_waveform
Store Waveform to Memory	zt1428_store_waveform
Load Array to Memory	zt1428_load_array
Low Level Operations	
Reset	zt1428_reset
Device Clear	zt1428_device_clear
Self Test	zt1428_self_test
Run/Stop	zt1428_run_stop
Calibrate	zt1428_calibrate
Save/Recall State	zt1428_save_recall
Get ID and Version	zt1428_id_version
Get Error	zt1428_error
Get Running	zt1428_running
Wait for Operation Complete	zt1428_wait_op_complete
Close	zt1428_close

ZT1428VXI Digitizing Oscilloscope

Instrument Name: Ztec Instruments ZT1428VXI
Digitizing Oscilloscope

Description: This instrument module provides programming support for the ZT1428VXI. The module is divided into the following functions:

Functions/Classes:

(1) Initialize
Initialize the instrument and set to default configuration.

(2) Configure
This class of functions set the vertical, acquisition, function, external input, outputs, and trigger settings on the instrument.

(3) Configuration Readback
This class of functions query the instrument settings.

(4) Measure
This class of functions select and retrieve measurements.

(5) Waveform Operations
This class of functions digitize, store, and retrieve waveform data.

(6) Low Level Operations
This class of functions perform basic low level routines.

(7) Close
Take the instrument offline.

The following functions are in alphabetical order.

---

zt1428_acquisition

```
int zt1428_acquisition (ViSession instrumentHandle, int number_ofPoints,
                        double sampleInterval, int timebaseReference,
                        double timebaseDelay, int triggerMode,
                        int acquireType, int acquireCount);
```

Purpose

Set Acquisition

Congfigures the acquisition and timebase settings
of the oscilloscope (horizontal-axis settings).

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the
Initialize function to select the desired
instrument.

number_ofPoints

Variable Type int

Number of Points

Specifies the number of points for each waveform.

Valid Range depends upon Sample Interval:
100 to Max_points

Max_points = 125,000 for Sample Interval > 10 us
Max_points = 1,000,000 for Sample Interval <= 10 us

sampleInterval

Variable Type double

Sample Interval

Specifies the acquisition sampling interval in

seconds.

Valid Range:
20 ps (50 GS/s) to 1 sec (1 S/s) in 1, 2, 4 steps

timebaseReference

Variable Type int

Timebase Reference

Specifies the timebase reference to the left, center, or right of the active waveform.

0 - ZT1428_ACQ_LEFT - Left
1 - ZT1428_ACQ_CENT - Center
2 - ZT1428_ACQ_RIGHT - Right

timebaseDelay

Variable Type double

Timebase Delay

Specifies the timebase delay, the time between the trigger event and the waveform timebase reference point. This value is specified in seconds.

Valid Range depends upon Number of Points, Sample Interval, and Timebase Reference:
Minimum to 500 s

Minimum = -Max_Points + (Ref * Number of Points)
Max_points = 125,000 for Sample Interval > 10 us
Max_points = 1,000,000 for Sample Interval <= 10 us
Ref = 0 for Left Timebase Reference
Ref = 0.5 for Center Timebase Reference
Ref = 1.0 for Right Timebase Reference

triggerMode

Variable Type int

Trigger Mode

Selects the trigger mode to enable automatic triggering in absence of trigger event.

0 - ZT1428_ACQ_AUTO - Auto
1 - ZT1428_ACQ_SING - Single
2 - ZT1428_ACQ_TRIG - Triggered

acquireType

Variable Type int

Acquire Type

Specifies the type of acquisition that is to take place when a Digitize or Run command is executed. In Normal mode, a single waveform is captured. In Average mode, multiple captured waveforms are averaged. In Envelope mode, the minimum and maximum values of multiple captured waveforms are used to create an envelope.

Valid Range:
0 - ZT1428_ACQ_NORM - Normal
1 - ZT1428_ACQ_AVER - Average
2 - ZT1428_ACQ_ENV - Envelope

acquireCount

Variable Type int

Acquire Count

Specifies the acquisition count for repetitive aquisition modes. In Normal mode, this parameter is ignored. In Average mode, this specifies the number of waveforms to be averaged before the acquisition is complete. In Envelope mode, this specifies the number of waveforms for which to capture minimum and maximumvalues before the acquisition is complete.

Valid Range:
1 to 2048

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_auto_logic

```
int zt1428_auto_logic (ViSession instrumentHandle, int channel,
                       int logic);
```

Purpose

Auto Logic Setup

Configures the vertical settings for selected channel to standard logic levels (either TTL

or ECL). The affected settings are:
- Channel Voltage Range
- Channel DC Offset
- Channel Coupling
- Trigger Level

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

channel

Variable Type int

Channel

Selects the channel to be configured.

Valid Range:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2

logic

Variable Type int

Logic

Selects the logic to set the selected channel(s). The offset, range, coupling, and trigger level are configured for the selected logic type.

Valid Range:
0 - ZT1428_LOGIC_TTL - TTL Logic
1 - ZT1428_LOGIC_ECL - ECL Logic

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_auto_setup

int zt1428_auto_setup (ViSession instrumentHandle);

Purpose

Auto Setup

Commands the instrument to autoscale.
Autoscale disables the following controls:
- All markers OFF
- All memories OFF
- Functions OFF
- Measurements OFF

Autoscale determines settings for the applied
input signals, affecting the following controls:
- Channel Offset as required
- Channel Range as required
- Channel Coupling as required
- Channel State On/Off as required
- Timebase Range as required
- Trigger level as required
- Trigger mode to edge

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the
Initialize function to select the desired
instrument.

Return Value

Control Name: Error

Description: Displays status relating to the
function call.

---

zt1428_calibrate

int zt1428_calibrate (ViSession instrumentHandle, int *result);

Purpose

Calibrate

Performs a calibration routine on the instrument
and returns the result. The calibration may take

up to 10 minutes to complete. Note that the two

input channels must be disconnected before starting the calibration.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

result

Variable Type int (passed by reference)

Result

Specifies the variable name in which to place the result of the calibration. If zero is returned, the internal self-calibration was successful.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_close

int zt1428_close (ViSession instrumentHandle);

Purpose

Close

Close the VISA session.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_delay_parameters

```
int zt1428_delay_parameters (ViSession instrumentHandle, int startSlope,
                             int startEdge, int startLevel,
                             int stopSlope, int stopEdge,
                             int stopLevel);
```

Purpose

Set Delay Parameters

Sets the start and stop conditions for delay measurements.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

startSlope

Variable Type int

Start Slope

Specifies the slope for the start condition in Delay measurements.

Valid Values:
0 - ZT1428_DEL_SLOP_NEG - Negative Slope
1 - ZT1428_DEL_SLOP_POS - Positive Slope

startEdge

Variable Type int

Start Edge

Specifies the edge for the start condition in Delay measurements.

Valid Values:
1 to 4000

startLevel

Variable Type int

Start Level

Specifies the level for the start condition in Delay measurements.

Valid Values:
0 - ZT1428_DEL_LEV_LOW - Lower
1 - ZT1428_DEL_LEV_MID - Middle
2 - ZT1428_DEL_LEV_UPP - Upper

stopSlope

Variable Type int

Stop Slope

Specifies the slope for the stop condition in Delay measurements.

Valid Values:
0 - ZT1428_DEL_SLOP_NEG - Negative Slope
1 - ZT1428_DEL_SLOP_POS - Positive Slope

stopEdge

Variable Type int

Stop Edge

Specifies the edge for the stop condition in Delay measurements.

Valid Values:
1 to 4000

stopLevel

Variable Type int

Stop Level

Specifies the level for the stop condition in Delay measurements.

Valid Values:
0 - ZT1428_DEL_LEV_LOW - Lower
1 - ZT1428_DEL_LEV_MID - Middle
2 - ZT1428_DEL_LEV_UPP - Upper

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_device_clear

```
int zt1428_device_clear (ViSession instrumentHandle);
```

Purpose

Device Clear

Low-level VXIbus device clear that resets the command interface to the instrument.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_dig_complete

```
int zt1428_dig_complete (ViSession instrumentHandle, int *digComplete);
```

Purpose

Digitize Waveform

Returns the digitize operation complete status. This is used with the asynchronous digitize mode of the Digitize Waveform function to synchronize the digitize operation.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

digComplete

Variable Type int (passed by reference)

Dig Complete

Specifies the variable name in which to place the status of an on-going digitize operation. A returned value of 1 indicates that the digitize operation is complete. A returned value of 0 indicates that the operation is still in progress.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_digitize_waveform

```
int zt1428_digitize_waveform (ViSession instrumentHandle, int channel_s,
                              int mode);
```

Purpose

Digitize Waveform

Commands the oscilloscope to digitize the waveform for the specified source(s). Normal digitize mode waits for the digitize operation to complete. Asynchronous digitize mode uses the Get Digitize Complete function to synchronize the digitize operation.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

channel_s

Variable Type int

Channel(s)

Selects the channel(s) to be digitized.

Valid Range:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2
10 - ZT1428_CHAN_BOTH - Channels 1 & 2

mode

Variable Type int

Mode

Specifies the mode to be used for a digitize operation. Normal operation uses the operation complete query to halt all instrument communication unitl the digitize operation is complete. Asynchronous digitize mode sets the instrument to use its status register reporting to identify when the digitize operation is complete. Asynchronous digitize mode should only be used by advanced users familier with the IEEE-488 status register reporting structures.

Valid Values:
0 - ZT1428_DIG_NORM - Normal
1 - ZT1428_DIG_ASYN - Asynchronous

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_edge_trigger

```
int zt1428_edge_trigger (ViSession instrumentHandle, int source,
                         double level, int slope, int sensitivity);
```

Purpose

Set Edge Trigger

Configures the oscilloscope for edge triggering.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

source

Variable Type int

Source

Specifies the source for the trigger signal.

Valid Values:
1 - ZT1428_TRG_CHAN1 - Chan 1
2 - ZT1428_TRG_CHAN2 - Chan 2
3 - ZT1428_TRG_EXT - External
4 - ZT1428_TRG_ECL0 - ECL 0
5 - ZT1428_TRG_ECL0 - ECL 1

level

Variable Type double

Level

Specifies the trigger level of the selected source in Volts.

Valid Range:
ñ0.75 of the current voltage range from the current offset.

slope

Variable Type int

Slope

Specifies the trigger slope for the specified source.

Valid Value:
0 - ZT1428_TRG_SLOPE_NEG - Negative slope
1 - ZT1428_TRG_SLOPE_POS - Positive slope

sensitivity

Variable Type int

Sensitivity

Specifies the trigger filter mode. If Normal is selected, trigger filtering is turned off. If Low is selected, noise rejection hysteresis is enabled. If Low Freq Reject is selected, the trigger signal is AC coupled with a 50 kHz high-pass filter. If High Freq Reject is selected, the trigger signal is filtered with a 50 kHz low-pass filter.

Valid Range:
0 - ZT1428_TRG_SENS_NORM - Normal
1 - ZT1428_TRG_SENS_LOW - Low (Noise Reject)
2 - ZT1428_TRG_SENS_LFR - Low Freq Reject
3 - ZT1428_TRG_SENS_HFR - High Freq Reject

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_error

int zt1428_error (ViSession instrumentHandle, int *instrumentError);

Purpose

Get Error

Returns the instrument error code for an existing error. Also clears the instrument error light when all errors are read.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

instrumentError

Variable Type int (passed by reference)

Instrument Error

Specifies the variable name in which to place the instrument error code.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_ext_input

```
int zt1428_ext_input (ViSession instrumentHandle, int externalMode,
                      double externalLevel, int externalImpedance);
```

Purpose

Set External Input

Configures the Ext Trig BNC input connection which has the dual functionality of external trigger input and external 100MHz timebase clock input.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

externalMode

Variable Type int

External Mode

Specifies the external connector input function. If Trigger is specified, the external connector is used as a trigger input and the internal clock reference is used. If Clock is specified, an external 100 MHz clock must be applied to the external input for use as the timebase reference. In clock mode, the external trigger function cannot be used.

Valid Range:
0 - ZT1428_EXT_MODE_TRIG - Trigger (Internal Clock)

1 - ZT1428_EXT_MODE_CLK - Clock (External Clock)

externalLevel

Variable Type double

External Level

Specifies the threshold voltage level of the external trigger or sample clock connected to the EXT TRIG input.

Valid Range:
-2.0 V to 2.0 V

externalImpedance

Variable Type int

External Impedance

Specifies the input impedance for the external trigger or clock input.

Valid Range:
0 - ZT1428_EXT_IMP_1M - 1Mê
1 - ZT1428_EXT_IMP_50 - 50ê

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_function

```
int zt1428_function (ViSession instrumentHandle, int functionNumber,
                     int operation, int source1, int source2,
                     int functionState, double range, double offset);
```

Purpose

Set Math Function

Configures the waveform math functions of the oscilloscope.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

functionNumber

Variable Type int

Function Number

Specifies the function to be configured.

Valid Values:
7 - ZT1428_FUNC1 - Function 1
8 - ZT1428_FUNC2 - Function 2

operation

Variable Type int

Operation

Specifies what operation is to take place. The difference, integrate, invert, and only operations ignore the second source.

Valid Values:
0 - ZT1428_FUNC_ADD - Add
1 - ZT1428_FUNC_SUB - Subtract
2 - ZT1428_FUNC_MULT - Multiply
3 - ZT1428_FUNC_DIFF - Difference
4 - ZT1428_FUNC_INT - Integrate
5 - ZT1428_FUNC_INV - Invert
6 - ZT1428_FUNC_ONLY - Only

source1

Variable Type int

Source 1

Specifies the channel to be used as the first operand. In operations that need only one operand this control selects the source.

Valid Values:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4

source2

Variable Type int

Source 2

Specifies the channel to be used as the second operand. In operations that need only one operand this control has no effect.

Valid Values:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4

functionState

Variable Type int

Function State

Controls the function on/off state. Unused math functions should be disabled to decrease waveform processing time.

Valid Values:
0 - ZT1428_FUNC_OFF - Function Off
1 - ZT1428_FUNC_ON - Function On

range

Variable Type double

Range

Specifies the full scale range in volts for the specified function channel.

Valid Range:
0.0 or 1E-38 to 1E+38
0.0 leaves the ZT1428VXI-calculated range and offset values unchanged at the auto-calculated values.

offset

Variable Type double

Offset

Specifies the DC offset in volts for the specified function channel.

Valid Range:
-1E+38 to 1E+38

Note: A 0.0 Range Control setting leaves the ZT1428VXI-calculated range and offset values unchanged at the auto-calculated values.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_id_version

```
int zt1428_id_version (ViSession instrumentHandle, char instrumentID[],
                       double *driverVersion);
```

Purpose

Get ID and Version

Returns the instrument identification string and the CVI driver version.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

instrumentID

Variable Type char []

Instrument ID

Specifies the variable name in which to place the instrument id string (returned from *IDN?). This array must be at least 100 characters in length.

driverVersion

Variable Type double (passed by reference)

Driver Version

Specifies the variable name in which to place the CVI driver version.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_init

```
int zt1428_init (ViRsrc resourceName, ViPSession instrumentHandle);
```

Purpose

Initialize

This routine performs the following initialization:
- Opens the instrument by starting a VISA Session.
- Performs an identification query on the Instrument.
- Verifies that that the instrumnet is in advanced mode.
- Returns an Instrument Handle which is used to differentiate between instruments of the same model type. This value will be used to identify the instrument in subsequent calls.

Parameter List

resourceName

Variable Type ViRsrc

Resource Name

This control specifies the interface and address of the device that is to be initialized (Instrument Descriptor). The exact grammar to be used in this control is:
GPIB[board]::primary addr[::second addr][::INSTR]
VXI[board]::logical address::INSTR

instrumentHandle

Variable Type ViSession (passed by reference)

Instrument Handle

This control returns an Instrument Handle that is

used in all subsequent function calls to differentiate between different sessions of this instrument driver. Each time this function is invoked a Unique Session is opened. It is possible to have more than one session open for the same resource.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_init_with_options

```
ViStatus zt1428_init_with_options (ViRsrc resourceName,
                                   ViBoolean IDQuery,
                                   ViBoolean resetDevice,
                                   ViPSession instrumentHandle);
```

Parameter List

resourceName

Variable Type ViRsrc

This control specifies the interface and address of the device that is to be initialized (Instrument Descriptor). The exact grammar to be used in this control is shown in the note below.

Default Value: "GPIB::1"

Notes:

(1) Based on the Instrument Descriptor, this operation establishes a communication session with a device. The grammar for the Instrument Descriptor is shown below. Optional parameters are shown in square brackets ([]).

Interface	Grammar
GPIB	GPIB[board]::primary address[::secondary address] [::INSTR]

The GPIB keyword is used with GPIB instruments.

The default value for optional parameters are shown below.

Optional Parameter	Default Value
board	0

secondary address none - 31

IDQuery

Variable Type ViBoolean

This control specifies if an ID Query is sent to the instrument during the initialization procedure.

Valid Range:
VI_OFF (0) - Skip Query
VI_ON (1) - Do Query (Default Value)

Notes:

(1) Under normal circumstances the ID Query ensures that the instrument initialized is the type supported by this driver. However circumstances may arise where it is undesirable to send an ID Query to the instrument. In those cases; set this control to "Skip Query" and this function will initialize the selected interface, without doing an ID Query.

/**** DELETE THIS NOTE AND THE STATUS CODE IF SUPPORTED *****/
(2) If this instrument does not support an ID Query, and this control is set to "Do Query" then this function should return the Warning Code 0x3FFC0101 - VI_WARN_NSUP_ID_QUERY.

resetDevice

Variable Type ViBoolean

This control specifies if the instrument is to be reset to its power-on settings during the initialization procedure.

Valid Range:
VI_OFF (0) - Don't Reset
VI_ON (1) - Reset Device (Default Value)

Notes:

(1) If you do not want the instrument reset. Set this control to "Don't Reset" while initializing the instrument.

/**** DELETE THIS NOTE AND THE STATUS CODE IF SUPPORTED *****/
(2) If this instrument does not support a Reset, and this control is set to "Reset Device" then this function should return the Warning Code 0x3FFC0102 - VI_WARN_NSUP_RESET.

instrumentHandle

Variable Type ViSession (passed by reference)

This control returns an Instrument Handle that is used in all subsequent function calls to differentiate between different sessions

of this instrument driver.

Notes:

(1) Each time this function is invoked a Unique Session is opened. It is possible to have more than one session open for the same resource.

Return Value

This control contains the status code returned by the function call.

Status Codes:

Status	Description
0	No error (the call was successful).
3FFC0101	ID Query not supported - VI_WARN_NSUP_ID_QUERY
3FFC0102	Reset not supported - VI_WARN_NSUP_RESET
3FFC0103	Self Test not supported - VI_WARN_NSUP_SELF_TEST
3FFC0104	Error Query not supported - VI_WARN_NSUP_ERROR_QUERY
3FFC0105	Revision Query not supported - VI_WARN_NSUP_REV_QUERY
3FFF0005	The specified termination character was read.
3FFF0006	The specified number of bytes was read.
BFFC0001	Parameter 1 out of range. (String not range checked)
BFFC0002	Parameter 2 (ID Query) out of range.
BFFC0003	Parameter 3 (Reset Device) out of range.
BFFC0004	Parameter 4 out of range.
BFFC0005	Parameter 5 out of range.
BFFC0006	Parameter 6 out of range.
BFFC0007	Parameter 7 out of range.
BFFC0008	Parameter 8 out of range.
BFFC0011	Instrument returned invalid response to ID Query
BFFC0800	Error Opening File VI_ERROR_INSTR_FILE_OPEN
BFFC0801	Error Writing to File VI_ERROR_INSTR_FILE_WRITE
BFFC0803	Invalid Response VI_ERROR_INSTR_INTERPRETING_RESPONSE
BFFC0809	Parameter 9 out of range. VI_ERROR_INSTR_PARAMETER9
BFFC080A	Parameter 10 out of range. VI_ERROR_INSTR_PARAMETER10
BFFC080B	Parameter 11 out of range. VI_ERROR_INSTR_PARAMETER11
BFFC080C	Parameter 12 out of range. VI_ERROR_INSTR_PARAMETER12
BFFF0000	Miscellaneous or system error occurred.
BFFF000E	Invalid session handle.
BFFF0015	Timeout occurred before operation could complete.
BFFF0034	Violation of raw write protocol occurred.
BFFF0035	Violation of raw read protocol occurred.
BFFF0036	Device reported an output protocol error.
BFFF0037	Device reported an input protocol error.
BFFF0038	Bus error occurred during transfer.
BFFF003A	Invalid setup (attributes are not consistent).
BFFF005F	No listeners condition was detected.
BFFF0060	This interface is not the controller in charge.
BFFF0067	Operation is not supported on this session.

Notes:

(1) Parameter Error Codes for parameters 1 through 8 are defined in the vpptype.h header file the range is BFFC0001 - BFFC0008; Parameter Error Codes for parameters 9 through 15 are defined in the instrument driver's header file the range is BFFC0809 - BFFC080F; for parameter errors greater than 15, and other instrument specific error codes, use an error code in the range of BFFC0900 to BFFC0FFF. This is equivalent to using (VI_ERROR_INSTR_OFFSET + n); where n represents each instrument specific error number. Valid ranges for n are 0 to 6FF. (All values are given in Hexadecimal Notation)

(2) Delete all unused status codes from the Status Control of each function panel when you are finished development of your instrument driver, for example in this control the status codes for parameters 1, 3-8, and the codes for Error Opening and Writing to File should be deleted. Those status codes are provided here as a convenience for during driver development.

(3) Delete these three (3) notes when you are finished with your driver development.

---

zt1428_limit_test

```
int zt1428_limit_test (ViSession instrumentHandle, int limitTest,
                       int statistics, int primarySource,
                       int secondarySource, int measurement,
                       double upperLimit, double lowerLimit,
                       int postfailure, int destination);
```

Purpose

Set Limit Test

Sets the instrument to perform limit test measurement comparisons or statistical measurement recording. Up to three different limit test or statistical measurements may be specified.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

limitTest

Variable Type int

Limit Test

Controls the on/off state of the limit testing. If limit testing is enabled, the high, low and pass/fail statistics are recorded for the specified measurement over many continuous acquisitions. The continuous acquisition is started by a run command. The results of the limit test are returned in the result statistics and limit test event register.

Valid Values:
0 - ZT1428_MEAS_LIM_OFF - Limit Test Off
1 - ZT1428_MEAS_LIM_ON - Limit Test On

statistics

Variable Type int

Statistics

Controls the on/off state of the statistics. If statistics are enabled, the high, low and average statistics are recorded for the specified measurement over many continuous acquisitions. The continuous acquisition is started by a run command. The measurement statistics are returned in the result statistics.

Valid Values:
0 - ZT1428_MEAS_STAT_OFF - Statistics Off
1 - ZT1428_MEAS_STAT_ON - Statistics On

primarySource

Variable Type int

Primary Source

Specifies the source for the measurement function. Valid sources include input channels, waveforms saved in memory, and math function waveforms.

Valid Values:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4
7 - ZT1428_FUNC1 - Function 1
8 - ZT1428_FUNC2 - Function 2

secondarySource

Variable Type int

Secondary Source

Specifies the secondary source for the measurement function. This is only used in delay measurements.

Valid Values:
0 - ZT1428_NONE - None Selected
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4
7 - ZT1428_FUNC1 - Function 1
8 - ZT1428_FUNC2 - Function 2

measurement

Variable Type int

Measurement

Specifies the measurement to be performed.

Valid Values:
0 - ZT1428_MEAS_RISE - Rise Time
1 - ZT1428_MEAS_FALL - Fall Time
2 - ZT1428_MEAS_FREQ - Frequency
3 - ZT1428_MEAS_PER - Period
4 - ZT1428_MEAS_PWID - +Width
5 - ZT1428_MEAS_NWID - -Width
6 - ZT1428_MEAS_VAMP - V. Amplitude
7 - ZT1428_MEAS_VBAS - V. Base
8 - ZT1428_MEAS_VTOP - V. Top
9 - ZT1428_MEAS_VPP - V. Peak to Peak
10 - ZT1428_MEAS_VAVG - V. Average
11 - ZT1428_MEAS_VMAX - V. Max
12 - ZT1428_MEAS_VMIN - V. Min
13 - ZT1428_MEAS_VACR - V. AC(rms)
14 - ZT1428_MEAS_VDCR - V. DC(rms)
15 - ZT1428_MEAS_DUTY - Duty Cycle
16 - ZT1428_MEAS_DEL - Delay
17 - ZT1428_MEAS_OVER - Over Shoot
18 - ZT1428_MEAS_PRE - Pre Shoot

upperLimit

Variable Type double

Upper Limit

Specifies the upper limit of the measurement

limit test comparison.

Valid Values depends upon Measurement

lowerLimit

Variable Type double

Lower Limit

Specifies the lower limit of the measurement limit test comparison.

Valid Values depends upon Measurement

postfailure

Variable Type int

Post Failure

Specifies the postfailure condition. If set to Stop, the instrument will stop acquiring waveforms after a limit test comparison failure.

Valid Values:
0 - ZT1428_MEAS_POST_STOP - Stop upon Failure
1 - ZT1428_MEAS_POST_CONT - Continue upon Failure

destination

Variable Type int

Destination

Specifies the destination for the waveform to be stored when a limit test fails.

Note: When storing in envelope acq. mode, the min. and max. waveforms are stored in two memories. For example, storing the wave to memory 1 will place the min. waveform in memory 1 and the max. waveform in memory 2. Memories are grouped as 1 & 2, and 3 & 4. Selecting 1 or 2 has the same effect. Selecting 3 or 4 has the same effect.

Valid Values:
0 - ZT1428_NONE - Not Saved Upon Failure
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_load_array

```
int zt1428_load_array (ViSession instrumentHandle, int destination,
                       double waveformArray[], int number_ofPoints,
                       double sampleInterval, double timeOffset,
                       int xReference, double voltIncrement,
                       double voltOffset, int yReference);
```

Purpose

Load Array to Memory

Loads waveform data from an array to the specified waveform memory location.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

destination

Variable Type int

Destination

Specifies the destination for the waveform to be stored.

Valid Values:
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4

waveformArray

Variable Type double []

Waveform Array

Specifies the name of array of waveform data to

be stored. The waveform is specified in voltage units and converted to codes according to the preamble settings.

number_ofPoints

Variable Type int

Number of Points

Specifies the number of points to be stored to the selected waveform.

sampleInterval

Variable Type double

Sample Interval

Specifies the sample interval in seconds at which the waveform to be stored was digitized (i.e. time interval between points).

timeOffset

Variable Type double

Time Offset

Specifies the time of the first data point in seconds relative to the trigger point of the waveform to be stored.

xReference

Variable Type int

X Reference

Specifies the horizontal axis trigger reference point of the waveform to be stored.

voltIncrement

Variable Type double

Volt Increment

Specifies the voltage increment in volts at which the waveform to be stored was digitized (voltage increment between LSBs).

voltOffset

Variable Type double

Volt Offset

Specifies the zero-voltage reference or DC offset voltage of the waveform to be stored.

yReference

Variable Type int

Y Reference

Specifies the vertical axis voltage reference point of the waveform to be stored.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_mask_test

```
int zt1428_mask_test (ViSession instrumentHandle, int maskTest,
                      int source, int mask, double allowance,
                      int postfailure, int destination);
```

Purpose

Set Mask Test

Sets the instrument to perform mask test waveform comparisons.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

maskTest

Variable Type int

Mask Test

Controls the on/off state of the mask testing. If mask testing is enabled, the source input is compared to the mask over many continuous acquisitions. The continuous acquisition is started by a run command. The result of the mask test is returned in the limit test event register.

Valid Values:
0 - ZT1428_MEAS_MASK_OFF - Mask Test Off
1 - ZT1428_MEAS_MASK_ON - Mask Test On

source

Variable Type int

Source

Specifies the source for the mask test function. Valid sources include the two input channels.

Valid Values:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2

mask

Variable Type int

Mask

Selects the mask waveforms to which the source will be compared. The maximum waveform mask is stored in Memory 1 or 3. The minimum waveform mask is stored in Memory 2 or 4.

Valid Values:
3 - ZT1428_WMEM1 - Memory 1 & 2
5 - ZT1428_WMEM3 - Memory 3 & 4

allowance

Variable Type double

Allowance

Specifies the allowable number of divisions that the waveform mask comparison test can deviate from and still pass. One division is 1/8 of the full-scale range of the selected input source.

Valid Values:
0.0 to 8.0 divisions

postfailure

Variable Type int

Post Failure

Specifies the postfailure condition. If set to Stop, the instrument will stop acquiring waveforms after a mask test comparison failure.

Valid Values:
0 - ZT1428_MEAS_POST_STOP - Stop upon Failure
1 - ZT1428_MEAS_POST_CONT - Continue upon Failure

destination

Variable Type int

Destination

Specifies the destination for the waveform to be stored when a mask test fails. Data may be stored to any of the waveform memories EXCEPT the pair of memories used for the mask in the comparison test.

Valid Values:
0 - ZT1428_NONE - Not Saved Upon Failure
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_measurement

```
int zt1428_measurement (ViSession instrumentHandle, int primarySource,
                        int secondarySource, int measurement,
                        double *result);
```

Purpose

Get Measurement

Causes the instrument to make the specified measurement on a previously captured waveform and returns the result.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

primarySource

Variable Type int

Primary Source

Specifies the source for the measurement function. Valid sources include input channels, waveforms saved in memory, and math function waveforms.

Valid Values:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4
7 - ZT1428_FUNC1 - Function 1
8 - ZT1428_FUNC2 - Function 2

secondarySource

Variable Type int

Secondary Source

Specifies the secondary source for the measurement function. This is only used in delay measurements.

Valid Values:
0 - ZT1428_NONE - None Selected
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4
7 - ZT1428_FUNC1 - Function 1
8 - ZT1428_FUNC2 - Function 2

measurement

Variable Type int

Measurement

Specifies the measurement to be performed.

Valid Values:
0 - ZT1428_MEAS_RISE - Rise Time
1 - ZT1428_MEAS_FALL - Fall Time
2 - ZT1428_MEAS_FREQ - Frequency
3 - ZT1428_MEAS_PER - Period
4 - ZT1428_MEAS_PWID - +Width
5 - ZT1428_MEAS_NWID - -Width
6 - ZT1428_MEAS_VAMP - V. Amplitude
7 - ZT1428_MEAS_VBAS - V. Base
8 - ZT1428_MEAS_VTOP - V. Top
9 - ZT1428_MEAS_VPP - V. Peak to Peak
10 - ZT1428_MEAS_VAVG - V. Average
11 - ZT1428_MEAS_VMAX - V. Max
12 - ZT1428_MEAS_VMIN - V. Min
13 - ZT1428_MEAS_VACR - V. AC(rms)
14 - ZT1428_MEAS_VDCR - V. DC(rms)
15 - ZT1428_MEAS_DUTY - Duty Cycle
16 - ZT1428_MEAS_DEL - Delay
17 - ZT1428_MEAS_OVER - Over Shoot
18 - ZT1428_MEAS_PRE - Pre Shoot
19 - ZT1428_MEAS_TMAX - T. Max
20 - ZT1428_MEAS_TMIN - T. Min

result

Variable Type double (passed by reference)

Result

Specifies the variable name in which to place
the result of the measurement. If 9.9999E+37
is returned, a result for the selected measurement
cannot be determined.

Return Value

Control Name: Error

Description: Displays status relating to the
function call.

---

zt1428_measurement_level

```
int zt1428_measurement_level (ViSession instrumentHandle, int userMode,
                              int units, double upperLevel,
                              double lowerLevel);
```

Purpose

Set Measurement Level

Sets the upper and lower threshold levels for measurements.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

userMode

Variable Type int

User Mode

Defines the measurement mode as either user-defined or standard for upper, middle and lower thresholds. This mode applies to all measurements that require threshold crossings. Standard values for the upper, middle and lower thresholds are 90%, 50% and 10%. A user threshold can be defined as either a percent of waveform level or as a specific voltage.

Valid Values:
0 - ZT1428_MEAS_MODE_STAN - Standard
1 - ZT1428_MEAS_MODE_USER - User

units

Variable Type int

Units

Specifies the units used for the user-defined limits as either a percent of waveform level or as a specific voltage.

Valid Values:
0 - ZT1428_MEAS_USER_PCT - Percent
1 - ZT1428_MEAS_USER_VOLT - Volts

upperLevel

Variable Type double

Upper Level

Specifies the upper threshold level for

measurements.

Valid range depends upon Units:

Units	Range
Percent	-25.00 to 125.00
Volts	-250,000 V to 250,000 V

lowerLevel

Variable Type double

Lower Level

Specifies the lower threshold level for measurements.

Valid range depends upon Units:

Units	Range
Percent	-25.00 to 125.00
Volts	-250,000 V to 250,000 V

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_outputs

```
int zt1428_outputs (ViSession instrumentHandle, int BNCOutput,
                    double BNCVoltage, int ECL0, int ECL1);
```

Purpose

Set Outputs

Configures the Probe Comp/Cal/Trig Output BNC connection and backplane ECLTRG0-1 trigger outputs.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

BNCOutput

Variable Type int

BNC Output

Specifies the output mode of the BNC Probe Comp/Cal/Trig Output connector. Probe selects a 500 Hz output. Trigger selects a trigger output pulse upon a detected trigger event. SClock selects a 10 MHz output. DC Calibrate, 0V and 5V select DC output levels.

Valid Range:
0 - ZT1428_OUT_BNC_PROB - Probe
1 - ZT1428_OUT_BNC_TRIG - Trigger
2 - ZT1428_OUT_BNC_DC - DC Calibrate
3 - ZT1428_OUT_BNC_0V - 0 Volts
4 - ZT1428_OUT_BNC_5V - 5 Volts
5 - ZT1428_OUT_BNC_SCL - SClock

BNCVoltage

Variable Type double

BNC Voltage

Specifies the active-state output voltage for the BNC output. For the Probe, Trigger and Sclock output modes, the signal transitions between 0V and this voltage level. For DC CAL mode, the DC output voltage is set at this level. This control is ignored for 0V and 5V output modes.

Valid Range:
-3.5V to +8.5V (into high impedance)

ECL0

Variable Type int

ECL 0

Turns the ECL 0 trigger output on or off. The ECL trigger output occurs when the instrument detects a trigger event.

Valid Values:
0 - ZT1428_OUT_OFF - Off
1 - ZT1428_OUT_ON - On

ECL1

Variable Type int

ECL 1

Turns the ECL 1 trigger output on or off. The ECL

trigger output occurs when the instrument detects
a trigger event.

Valid Values:
0 - ZT1428_OUT_OFF - Off
1 - ZT1428_OUT_ON - On

Return Value

Control Name: Error

Description: Displays status relating to the
function call.

---

zt1428_pattern_trigger

```
int zt1428_pattern_trigger (ViSession instrumentHandle, char logic[],
                            int condition, double GTTime, double LTTime,
                            double levelChan1, double levelChan2,
                            double levelExt, int sensitivity1,
                            int sensitivity2);
```

Purpose

Set Pattern Trigger

Configures the oscilloscope for pattern triggering.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the
Initialize function to select the desired
instrument.

logic

Variable Type char []

Logic

Specifies the logical relationship between
the signal and the defined voltage level that
must exist before the pattern is considered valid.
The logic pattern to be matched uses:
  L to represent logic Low
  H to represent logic High
  X to represent Don't Care
A five-character string should be specified.

The first character is for Channel 1,
the second for Channel 2, the third for External,
the fourth for ECLT0 and the last for ECLT1.

condition

Variable Type int

Condition

Sets the pattern condition that must be satisfied in order to generate a trigger event. In GT mode, the pattern must be present for more than the GT Time. In LT mode, the pattern must be present for less than the LT Time. In Range mode, the pattern must be present between the GT Time and the LT Time.

Valid Range:
0 - ZT1428_TRG_PATT_ENTER - Enter
1 - ZT1428_TRG_PATT_EXIT - Exit
2 - ZT1428_TRG_PATT_GT - Greater Than
3 - ZT1428_TRG_PATT_LT - Less Than
4 - ZT1428_TRG_PATT_RANGE - Between

GTTime

Variable Type double

GT Time

This parameter specifes the greater than time in seconds. The pattern must be present for more than this time when using either greater than mode or range mode.

Valid Values:
20 ns to 160 ms

LTTime

Variable Type double

LT Time

This parameter specifes the less than time in seconds. The pattern must be present for less than this time when using either less than mode or range mode.

Valid Values:
30 ns to 160 ms

levelChan1

Variable Type double

Level Chan1

Specifies the trigger level of input channel 1 in Volts.

Valid Range:
ñ0.75 of the current voltage range from the current offset.

levelChan2

Variable Type double

Level Chan2

Specifies the trigger level of input channel 2 in Volts.

Valid Range:
ñ0.75 of the current voltage range from the current offset.

levelExt

Variable Type double

Level Ext

Specifies the trigger level of the external trigger input in Volts.

Valid Range:
-2.0V to +2.0V

sensitivity1

Variable Type int

Sensitivity1

Specifies the trigger filter mode for input channel 1. If Normal is selected, trigger filtering is turned off. If Low is selected, noise rejection hysteresis is enabled. If Low Freq Reject is selected, the trigger signal is AC coupled with a 50 kHz high-pass filter. If High Freq Reject is selected, the trigger signal is filtered with a 50 kHz low-pass filter.

Valid Range:
0 - ZT1428_TRG_SENS_NORM - Normal
1 - ZT1428_TRG_SENS_LOW - Low (Noise Reject)
2 - ZT1428_TRG_SENS_LFR - Low Freq Reject
3 - ZT1428_TRG_SENS_HFR - High Freq Reject

sensitivity2

Variable Type int

Sensitivity2

Specifies the trigger filter mode for input channel 2. If Normal is selected, trigger filtering is turned off. If Low is selected, noise rejection hysteresis is enabled. If Low Freq Reject is selected, the trigger signal is AC coupled with a 50 kHz high-pass filter. If High Freq Reject is selected, the trigger signal is filtered with a 50 kHz low-pass filter.

Valid Range:
0 - ZT1428_TRG_SENS_NORM - Normal
1 - ZT1428_TRG_SENS_LOW - Low (Noise Reject)
2 - ZT1428_TRG_SENS_LFR - Low Freq Reject
3 - ZT1428_TRG_SENS_HFR - High Freq Reject

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_query_acquisition

```
int zt1428_query_acquisition (ViSession instrumentHandle,
                              int *number_ofPoints,
                              double *sampleInterval,
                              int *timebaseReference,
                              double *timebaseDelay, int *triggerMode,
                              int *acquireType, int *acquireCount);
```

Purpose

Query Acquistion

Queries the the acquisition and timebase settings of the oscilloscope (horizontal-axis settings).

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

number_ofPoints

Variable Type int (passed by reference)

Number of Points

Returns the number of points for each waveform.

Valid Range depends upon Sample Interval:
100 to Max_points

Max_points = 125,000 for Sample Interval > 10 us
Max_points = 1,000,000 for Sample Interval <= 10 us

sampleInterval

Variable Type double (passed by reference)

Sample Interval

Returns the acquisition sampling interval in seconds.

Valid Range:
20 ps (50 GS/s) to 1 sec (1 S/s) in 1, 2, 4 steps

timebaseReference

Variable Type int (passed by reference)

Timebase Reference

Returns the timebase reference to the left, center, or right of the active waveform.

0 - ZT1428_ACQ_LEFT - Left
1 - ZT1428_ACQ_CENT - Center
2 - ZT1428_ACQ_RIGHT - Right

timebaseDelay

Variable Type double (passed by reference)

Range

Returns the full scale acquisition range in volts for the specified input channel.

Valid Range depends upon probe attenuation (P):
0.008 * P to 50 * P

triggerMode

Variable Type int (passed by reference)

Trigger Mode

Returns the trigger mode to enable automatic triggering in absence of trigger event.

0 - ZT1428_ACQ_AUTO - Auto
1 - ZT1428_ACQ_SING - Single
2 - ZT1428_ACQ_TRIG - Triggered

acquireType

Variable Type int (passed by reference)

Acquire Type

Returns the type of acquisition that is to take place when a Digitize or Run command is executed. In Normal mode, a single waveform is captured. In Average mode, multiple captured waveforms are averaged. In Envelope mode, the minimum and maximum values of multiple captured waveforms are used to create an envelope.

Valid Range:
0 - ZT1428_ACQ_NORM - Normal
1 - ZT1428_ACQ_AVER - Average
2 - ZT1428_ACQ_ENV - Envelope

acquireCount

Variable Type int (passed by reference)

Acquire Count

Returns the acquisition count for repetitive aquisition modes. In Normal mode, this parameter is ignored. In Average mode, this specifies the number of waveforms to be averaged before the acquisition is complete. In Envelope mode, this specifies the number of waveforms for which to capture minimum and maximumvalues before the acquisition is complete.

Valid Range:
1 to 2048

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_query_adv_trigger

```
int zt1428_query_adv_trigger (ViSession instrumentHandle,
                              int *holdoffType, double *holdoffValue,
                              char logic[], int *patternCondition,
                              double *GTTime, double *LTTime,
                              int *stateCondition, int *standard,
                              int *field, int *line);
```

Purpose

Query Advanced Trigger

Queries the advanced triggering configuration of the oscilloscope.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

holdoffType

Variable Type int (passed by reference)

Holdoff Type

Returns the type of trigger holdoff.

Valid Values:
0 - ZT1428_TRG_HOLD_TIME - Time
1 - ZT1428_TRG_HOLD_EVENT - Event

holdoffValue

Variable Type double (passed by reference)

Holdoff Value

Returns the holdoff time in seconds or the holdoff events by number of events. This value depends upon the setting for the Holdfoff Type.

Valid Values:
40 ns to 320 ms
1 to 65536 events

logic

Variable Type char []

Logic

Returns the logical relationship between
the signal and the defined voltage level that
must exist before the pattern is considered valid.
The logic pattern to be matched uses:
  L to represent logic Low
  H to represent logic High
  X to represent Don't Care
A five-character string should be specified.
The first character is for Channel 1,
the second for Channel 2, the third for External,
the fourth for ECLT0 and the last for ECLT1.

patternCondition

Variable Type int (passed by reference)

Pattern Condition

Returns the pattern condition that must be satisfied
in order to generate a trigger event. In GT mode,
the pattern must be present for more than the GT
Time. In LT mode, the pattern must be present for
less than the LT Time. In Range mode, the pattern
must be present between the GT Time and the LT Time.

Valid Range:
0 - ZT1428_TRG_PATT_ENTER - Enter
1 - ZT1428_TRG_PATT_EXIT - Exit
2 - ZT1428_TRG_PATT_GT   - Greater Than
3 - ZT1428_TRG_PATT_LT   - Less Than
4 - ZT1428_TRG_PATT_RANGE - Between

GTTime

Variable Type double (passed by reference)

GT Time

Returns the greater than time in seconds. The
pattern must be present for more than this time
when using either greater than mode or range mode.

Valid Values:
20 ns to 160 ms

LTTime

Variable Type double (passed by reference)

LT Time

Specifes the less than time in seconds. The pattern must be present for less than this time when using either less than mode or range mode.

Valid Values:
30 ns to 160 ms

stateCondition

Variable Type int (passed by reference)

State Condition

Returns the condition for the pattern that must be present while detecting an edge on the selected trigger source.

Valid Values:
0 - ZT1428_TRG_STAT_FALSE - False
1 - ZT1428_TRG_STAT_TRUE - True

standard

Variable Type int (passed by reference)

Standard

Returns which TV standard to use.
525 - United States(60Hz) NTSC
625 - European(50Hz) PAL

Valid Range:
525 - ZT1428_TRG_TV_STAN_525 - NTSC
625 - ZT1428_TRG_TV_STAN_625 - PAL

field

Variable Type int (passed by reference)

Field

Returns the field for the standard video signal. This determines the line availability.

Valid Range:
1 - ZT1428_TRG_TV_FIELD1 - Field 1
2 - ZT1428_TRG_TV_FIELD2 - Field 2

line

Variable Type int (passed by reference)

Line

Returns which line in the TV signal will generate a trigger event.

Valid Range depends upon Standard and Field

Field	Standard	Range
1	525	1 to 263
2	525	1 to 262
1	625	1 to 313
2	625	314 to 625

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_query_ext_input

```
int zt1428_query_ext_input (ViSession instrumentHandle,
                            int *externalMode, double *externalLevel,
                            int *externalImpedance);
```

Purpose

Query External Input

Queries the setup of the Ext Trig BNC input connection which has the dual functionality of external trigger input and external 100MHz timebase clock input.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

externalMode

Variable Type int (passed by reference)

External Mode

Returns the external connector input function. If Trigger is specified, the external connector is used as a trigger input and the internal clock reference is used. If Clock is specified, an

external 100 MHz clock must be applied to the
external input for use as the timebase reference.
In clock mode, the external trigger function cannot
be used.

Valid Range:
0 - ZT1428_EXT_MODE_TRIG - Trigger (Internal Clock)
1 - ZT1428_EXT_MODE_CLK - Clock (External Clock)

externalLevel

Variable Type double (passed by reference)

External Level

Returns the threshold voltage level of the
external trigger or sample clock connected to
the EXT TRIG input.

Valid Range:
-2.0 V to 2.0 V

externalImpedance

Variable Type int (passed by reference)

External Impedance

Returns the input impedance for the external
trigger or clock input.

Valid Range:
0 - ZT1428_EXT_IMP_1M - 1Mê
1 - ZT1428_EXT_IMP_50 - 50ê

Return Value

Control Name: Error

Description: Displays status relating to the
function call.

---

zt1428_query_function

```
int zt1428_query_function (ViSession instrumentHandle,
                           int functionNumber, int *functionState,
                           double *range, double *offset);
```

Purpose

Query Math Function

Queries the waveform math setup of the selected

function.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

functionNumber

Variable Type int

Function Number

Specifies the function to be queried.

Valid Values:
7 - ZT1428_FUNC1 - Function 1
8 - ZT1428_FUNC2 - Function 2

functionState

Variable Type int (passed by reference)

Function State

Returns the function on/off state. Unused math functions should be disabled to decrease waveform processing time.

Valid Values:
0 - ZT1428_FUNC_OFF - Function Off
1 - ZT1428_FUNC_ON - Function On

range

Variable Type double (passed by reference)

Range

Returns the full scale range in volts for the specified function channel.

Valid Range:
0.0 or 1E-38 to 1E+38
0.0 leaves the ZT1428VXI-calculated range and offset values unchanged at the auto-calculated values.

offset

Variable Type double (passed by reference)

Offset

Returns the DC offset in volts
for the specified function channel.

Valid Range:
-1E+38 to 1E+38

Note: A 0.0 Range Control setting leaves the
ZT1428VXI-calculated range and offset values
unchanged at the auto-calculated values.

Return Value

Control Name: Error

Description: Displays status relating to the
function call.

---

zt1428_query_measurement

```
int zt1428_query_measurement (ViSession instrumentHandle, int *userMode,
                              int *units, double *upperLimit,
                              double *lowerLimit, int *startSlope,
                              int *stopSlope, int *startEdge,
                              int *stopEdge, int *startLevel,
                              int *stopLevel, int *positiveWidthLevel,
                              int *negativeWidthLevel);
```

Purpose

Query Measurement

Queries the upper and lower threshold levels, delay
parameters, and width parameters for measurements.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the
Initialize function to select the desired
instrument.

userMode

Variable Type int (passed by reference)

User Mode

Returns the measurement mode as either user-defined or standard for upper, middle and lower thresholds. This mode applies to all measurements that require threshold crossings. Standard values for the upper, middle and lower thresholds are 90%, 50% and 10%. A user threshold can be defined as either a percent of waveform level or as a specific voltage.

Valid Values:
0 - ZT1428_MEAS_MODE_STAN - Standard
1 - ZT1428_MEAS_MODE_USER - User

units

Variable Type int (passed by reference)

Units

Returns the units used for the user-defined limits as either a percent of waveform level or as a specific voltage.

Valid Values:
0 - ZT1428_MEAS_USER_PCT - Percent
1 - ZT1428_MEAS_USER_VOLT - Volts

upperLimit

Variable Type double (passed by reference)

Upper Limit

Returns the upper threshold level for measurements.

Valid range depends upon Units:

Units	Range
Percent	-25.00 to 125.00
Volts	-250,000 V to 250,000 V

lowerLimit

Variable Type double (passed by reference)

Lower Limit

Returns the lower threshold level for measurements.

Valid range depends upon Units:

Units	Range
Percent	-25.00 to 125.00

Volts -250,000 V to 250,000 V

startSlope

Variable Type int (passed by reference)

Start Slope

Returns the slope for the start condition in Delay measurements.

Valid Values:
0 - ZT1428_DEL_SLOP_NEG - Negative Slope
1 - ZT1428_DEL_SLOP_POS - Positive Slope

stopSlope

Variable Type int (passed by reference)

Stop Slope

Returns the slope for the stop condition in Delay measurements.

Valid Values:
0 - ZT1428_DEL_SLOP_NEG - Negative Slope
1 - ZT1428_DEL_SLOP_POS - Positive Slope

startEdge

Variable Type int (passed by reference)

Start Edge

Returns the edge number for the start condition in Delay measurements.

Valid Values:
1 to 4000

stopEdge

Variable Type int (passed by reference)

Stop Edge

Returns the edge number for the stop condition in Delay measurements.

Valid Values:
1 to 4000

startLevel

Variable Type int (passed by reference)

Start Level

Returns the level for the start condition in Delay measurements.

Valid Values:
0 - ZT1428_DEL_LEV_LOW - Lower
1 - ZT1428_DEL_LEV_MID - Middle
2 - ZT1428_DEL_LEV_UPP - Upper

stopLevel

Variable Type int (passed by reference)

Stop Level

Returns the level for the stop condition in Delay measurements.

Valid Values:
0 - ZT1428_DEL_LEV_LOW - Lower
1 - ZT1428_DEL_LEV_MID - Middle
2 - ZT1428_DEL_LEV_UPP - Upper

positiveWidthLevel

Variable Type int (passed by reference)

Positive Width Level

Returns the level for the positive pulse width measurements.

Valid Values:
0 - ZT1428_DEL_LEV_LOW - Lower
1 - ZT1428_DEL_LEV_MID - Middle
2 - ZT1428_DEL_LEV_UPP - Upper

negativeWidthLevel

Variable Type int (passed by reference)

Negative Width Level

Returns the level for the negative pulse width measurements.

Valid Values:
0 - ZT1428_DEL_LEV_LOW - Lower
1 - ZT1428_DEL_LEV_MID - Middle
2 - ZT1428_DEL_LEV_UPP - Upper

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_query_outputs

```
int zt1428_query_outputs (ViSession instrumentHandle, int *BNCOutput,
                          double *BNCVoltage, int *ECL0, int *ECL1);
```

Purpose

Query Outputs

Queries the configuration of the
Probe Comp/Cal/Trig Output BNC connection and
backplane ECLTRG0-1 trigger outputs.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the
Initialize function to select the desired
instrument.

BNCOutput

Variable Type int (passed by reference)

BNC Output

Returns the output mode of the BNC
Probe Comp/Cal/Trig Output connector.
Probe selects a 500 Hz output. Trigger
selects a trigger output pulse upon a
detected trigger event. SClock selects
a 10 MHz output. DC Calibrate, 0V and 5V
select DC output levels.

Valid Range:
0 - ZT1428_OUT_BNC_PROB - Probe
1 - ZT1428_OUT_BNC_TRIG - Trigger
2 - ZT1428_OUT_BNC_DC   - DC Calibrate
3 - ZT1428_OUT_BNC_0V   - 0 Volts
4 - ZT1428_OUT_BNC_5V   - 5 Volts
5 - ZT1428_OUT_BNC_SCL - SClock

BNCVoltage

Variable Type double (passed by reference)

BNC Voltage

Returns the active-state output voltage for the
BNC output. For the Probe, Trigger and Sclock

output modes, the signal transitions between 0V
and this voltage level. For DC CAL mode, the DC
output voltage is set at this level. This control
is ignored for 0V and 5V output modes.

Valid Range:
-3.5V to +8.5V (into high impedance)

ECL0

Variable Type int (passed by reference)

ECL 0

Returns the ECL 0 trigger output on or off state.
The ECL trigger output occurs when the instrument
detects a trigger event.

Valid Values:
0 - ZT1428_OUT_OFF - Off
1 - ZT1428_OUT_ON - On

ECL1

Variable Type int (passed by reference)

ECL 1

Returns the ECL 1 trigger output on or off state.
The ECL trigger output occurs when the instrument
detects a trigger event.

Valid Values:
0 - ZT1428_OUT_OFF - Off
1 - ZT1428_OUT_ON - On

Return Value

Control Name: Error

Description: Displays status relating to the
function call.

---

zt1428_query_trigger

```
int zt1428_query_trigger (ViSession instrumentHandle, int *source,
                          int *triggerMode, double *levelChan1,
                          double *levelChan2, double *levelExt,
                          int *sensitivity1, int *sensitivity2,
                          int *slopeChan1, int *slopeChan2,
                          int *slopeExt, int *slopeECL0,
                          int *slopeECL1);
```

Purpose

Query Trigger

Queries the triggering configuration of the oscilloscope.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

source

Variable Type int (passed by reference)

Source

Returns the source for the trigger signal.

Valid Values:
1 - ZT1428_TRG_CHAN1 - Chan 1
2 - ZT1428_TRG_CHAN2 - Chan 2
3 - ZT1428_TRG_EXT - External
4 - ZT1428_TRG_ECL0 - ECL 0
5 - ZT1428_TRG_ECL0 - ECL 1

triggerMode

Variable Type int (passed by reference)

Trigger Mode

Returns the selected trigger mode.

Valid Values:
0 - ZT1428_TRG_MODE_EDGE - Edge
1 - ZT1428_TRG_MODE_PATT - Pattern
2 - ZT1428_TRG_MODE_STAT - State
3 - ZT1428_TRG_MODE_TV - TV

levelChan1

Variable Type double (passed by reference)

Level Chan1

Returns the trigger level of input channel 1 in Volts.

Valid Range:
ñ0.75 of the current voltage range from the current

offset.

levelChan2

Variable Type double (passed by reference)

Level Chan2

Returns the trigger level of input channel 2 in Volts.

Valid Range:
ñ0.75 of the current voltage range from the current offset.

levelExt

Variable Type double (passed by reference)

Level Ext

Returns the trigger level of the external trigger input in Volts.

Valid Range:
-2.0V to +2.0V

sensitivity1

Variable Type int (passed by reference)

Sensitivity1

Returns the trigger filter mode for input channel 1. If Normal is selected, trigger filtering is turned off. If Low is selected, noise rejection hysteresis is enabled. If Low Freq Reject is selected, the trigger signal is AC coupled with a 50 kHz high-pass filter. If High Freq Reject is selected, the trigger signal is filtered with a 50 kHz low-pass filter.

Valid Range:
0 - ZT1428_TRG_SENS_NORM - Normal
1 - ZT1428_TRG_SENS_LOW - Low (Noise Reject)
2 - ZT1428_TRG_SENS_LFR - Low Freq Reject
3 - ZT1428_TRG_SENS_HFR - High Freq Reject

sensitivity2

Variable Type int (passed by reference)

Sensitivity2

Returns the trigger filter mode for input channel 2. If Normal is selected, trigger filtering is turned off. If Low is selected,

noise rejection hysteresis is enabled. If Low Freq Reject is selected, the trigger signal is AC coupled with a 50 kHz high-pass filter. If High Freq Reject is selected, the trigger signal is filtered with a 50 kHz low-pass filter.

Valid Range:
0 - ZT1428_TRG_SENS_NORM - Normal
1 - ZT1428_TRG_SENS_LOW - Low (Noise Reject)
2 - ZT1428_TRG_SENS_LFR - Low Freq Reject
3 - ZT1428_TRG_SENS_HFR - High Freq Reject

slopeChan1

Variable Type int (passed by reference)

Slope Chan1

Returns the trigger slope for the input channel 1.

Valid Value:
0 - ZT1428_TRG_SLOPE_NEG - Negative slope
1 - ZT1428_TRG_SLOPE_POS - Positive slope

slopeChan2

Variable Type int (passed by reference)

Slope Chan2

Returns the trigger slope for the input channel 2.

Valid Value:
0 - ZT1428_TRG_SLOPE_NEG - Negative slope
1 - ZT1428_TRG_SLOPE_POS - Positive slope

slopeExt

Variable Type int (passed by reference)

Slope Ext

Returns the trigger slope for the external trigger input.

Valid Value:
0 - ZT1428_TRG_SLOPE_NEG - Negative slope
1 - ZT1428_TRG_SLOPE_POS - Positive slope

slopeECL0

Variable Type int (passed by reference)

Slope ECL0

Returns the trigger slope for the ECLTRG0 trigger input.

Valid Value:
0 - ZT1428_TRG_SLOPE_NEG - Negative slope
1 - ZT1428_TRG_SLOPE_POS - Positive slope

slopeECL1

Variable Type int (passed by reference)

Slope ECL1

Returns the trigger slope for the ECLTRG1 trigger input.

Valid Value:
0 - ZT1428_TRG_SLOPE_NEG - Negative slope
1 - ZT1428_TRG_SLOPE_POS - Positive slope

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_query_vertical

```
int zt1428_query_vertical (ViSession instrumentHandle, int channel,
                           int *coupling, int *lowpassFilter,
                           double *probeAttenuation, double *range,
                           double *offset);
```

Purpose

Query Vertical

Queries the vertical settings for the selected channel.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired

instrument.

channel

Variable Type int

Channel

Selects the channel to be read back.

Valid Range:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2

coupling

Variable Type int (passed by reference)

Coupling

Returns the input coupling for the selected channel. The coupling for each channel can be set to AC, DC, or DCFifty, or ACLFR. DCFifty is DC coupling with 50 ohm impedance. ACLFR is AC coupling which also selects an internal high pass filter to reject frequencies below approximately 450Hz.

Valid Range:
0 - ZT1428_VERT_COUP_AC - AC 1Mê (10 Hz)
1 - ZT1428_VERT_COUP_ACLFR - AC 1Mê (450 Hz)
2 - ZT1428_VERT_COUP_DC - DC 1Mê
3 - ZT1428_VERT_COUP_DCF - DC 50ê

lowpassFilter

Variable Type int (passed by reference)

Lowpass Filter

Returns the state of an internal lowpass filter. When OFF, the lowpass filter is bypassed, providing approximately 250 MHz bandwidth. The bandwidth limit filter may be used with all coupling selections.

Valid Range:
0 - ZT1428_VERT_FILT_OFF - Off
1 - ZT1428_VERT_FILT_30MHZ - 30 MHz Lowpass Filter
2 - ZT1428_VERT_FILT_1MHZ - 1 MHz Lowpass Filter

probeAttenuation

Variable Type double (passed by reference)

Probe Attenuation

Returns the probe's attenuation factor for the specified channel. The probe attenuation changes the reference constants for scaling the vertical range and offset, automatic measurements, trigger levels, etc.

Valid Range:
0.9 to 1000.0

range

Variable Type double (passed by reference)

Range

Returns the full scale acquisition range in volts for the specified input channel.

Valid Range depends upon probe attenuation (P):
0.008 * P to 50 * P

offset

Variable Type double (passed by reference)

Offset

Returns the DC offset voltage that is represented at vertical center for the selected channel.

Valid Range depends upon range and probe attenuation (P):

Channel range	Offset Limit
8mV * P to 400mV * P	ñ2V * P
> 400mV * P to 2.0V * P	ñ10V * P
> 2.0V * P to 10.0V * P	ñ50V * P
> 10.0V * P to 50.0V * P	ñ250V * P

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_read_waveform

```
int zt1428_read_waveform (ViSession instrumentHandle, int source,
                          int transferType, double waveformArray[],
                          int *number_ofPoints, int *acquisitionCount,
                          double *sampleInterval, double *timeOffset,
                          int *xReference, double *voltIncrement,
                          double *voltOffset, int *yReference);
```

Purpose

Read Waveform to Array

Reads a waveform and its preamble information from the specified waveform source.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

source

Variable Type int

Source

Specifies the source waveform to be read. Valid sources include input channels, waveforms saved in memory, and math function waveforms.

Valid Values:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4
7 - ZT1428_FUNC1 - Function 1
8 - ZT1428_FUNC2 - Function 2

transferType

Variable Type int

Transfer Type

Specifies the type of data transfer to be used. A32 transfers are only available with VXI (non-GPIB) interfaces.

For Preamble transfers, the waveform arrway will not be returned. Only the preamble data is returned.

Note: A32 transfers can only be used with Input channels and Math Function channels. The

memories must be read using word-serial.

Valid Values:
0 - ZT1428_TRAN_SER - Word Serial
1 - ZT1428_TRAN_A32 - A32
2 - ZT1428_TRAN_PRE - Preamble

waveformArray

Variable Type double []

Waveform Array

Specifies the name of array in which to place the waveform data. The data is returned as an array of floating point numbers that represents the acquired waveform in voltage units.

Note: When the acquisition mode is set to envelope, two arrays will be returned. They will both be placed in this array. The first half of the array will be an array of minimums. The second half of the array will be an array of maximums.

number_ofPoints

Variable Type int (passed by reference)

Number of Points

Specifies the variable name in which to place the number of points read from the selected waveform.

Note: If the acquisition type is set to envelope then this number is the length of the entire array returned. Divide this number by two to get the length of each individual array.

acquisitionCount

Variable Type int (passed by reference)

Acquistion Count

Specifies the variable name in which to place the acquired waveform count used to create the selected average or envelope waveform. In Normal acquisition the Acquisition Count is always 1.

sampleInterval

Variable Type double (passed by reference)

Sample Interval

Specifies the variable name in which to place the

sample interval in seconds at which the waveform was digitized (i.e. time interval between points).

timeOffset

Variable Type double (passed by reference)

Time Offset

Specifies the variable name in which to place the time of the first data point in seconds relative to the trigger point.

xReference

Variable Type int (passed by reference)

X Reference

Specifies the variable name in which to place the horizontal axis trigger reference point.

voltIncrement

Variable Type double (passed by reference)

Volt Increment

Specifies the variable name in which to place the voltage increment in volts at which the waveform was digitized (voltage increment between LSBs).

voltOffset

Variable Type double (passed by reference)

Volt Offset

Specifies the variable name in which to place the zero-voltage reference or DC offset voltage for the specified waveform.

yReference

Variable Type int (passed by reference)

Y Reference

Specifies the variable name in which to place the vertical axis voltage reference point.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_reset

```
int zt1428_reset (ViSession instrumentHandle);
```

Purpose

Reset

Resets the instrument to its power-on state.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_result_stats

```
int zt1428_result_stats (ViSession instrumentHandle, int measurement,
                         double *current, double *minimum,
                         double *maximum, double *averagePassRatio,
                         int *limitTestResult);
```

Purpose

Get Result Statistics

Gets the statistical results of the statistics or limit test measurements, and the pass/fail results of the limit test or mask test. Because up to 3 statistical or limit test results can be returned, the measurement type is specified.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

measurement

Variable Type int

Measurement

Specifies the measurement results to be returned.

Valid Values:
0 - ZT1428_MEAS_RISE - Rise Time
1 - ZT1428_MEAS_FALL - Fall Time
2 - ZT1428_MEAS_FREQ - Frequency
3 - ZT1428_MEAS_PER - Period
4 - ZT1428_MEAS_PWID - +Width
5 - ZT1428_MEAS_NWID - -Width
6 - ZT1428_MEAS_VAMP - V. Amplitude
7 - ZT1428_MEAS_VBAS - V. Base
8 - ZT1428_MEAS_VTOP - V. Top
9 - ZT1428_MEAS_VPP - V. Peak to Peak
10 - ZT1428_MEAS_VAVG - V. Average
11 - ZT1428_MEAS_VMAX - V. Max
12 - ZT1428_MEAS_VMIN - V. Min
13 - ZT1428_MEAS_VACR - V. AC(rms)
14 - ZT1428_MEAS_VDCR - V. DC(rms)
15 - ZT1428_MEAS_DUTY - Duty Cycle
16 - ZT1428_MEAS_DEL - Delay
17 - ZT1428_MEAS_OVER - Over Shoot
18 - ZT1428_MEAS_PRE - Pre Shoot

current

Variable Type double (passed by reference)

Current

Specifies the name of the variable into which the current result of the measurement is placed.

minimum

Variable Type double (passed by reference)

Minimum

Specifies the name of the variable into which the minimum result of the measurement is placed.

maximum

Variable Type double (passed by reference)

Maximum

Specifies the name of the variable into which the maximum result of the measurement is placed.

averagePassRatio

Variable Type double (passed by reference)

Average Pass Ratio

Specifies the name of the variable into which the average (Statistics Mode) or pass ratio (Limit Test Mode) result of the measurement is placed.

limitTestResult

Variable Type int (passed by reference)

Limit Test Result

Specifies the name of the variable into which the result of the limit test or mask test comparison is placed.

Valid Values:
0 - Passed
1 - Failed

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_run_stop

int zt1428_run_stop (ViSession instrumentHandle, int state);

Purpose

Run/Stop

Enables or disables continuous data acquisition.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

state

Variable Type int

State

Specifies state in which to place the instrument. Run enables continuous acquisition. Stop disables an on-going acquisition.

Valid Values:
0 - ZT1428_STOP - Stop
1 - ZT1428_RUN - Run

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_running

int zt1428_running (ViSession instrumentHandle, int *state);

Purpose

Get Run/Stop

Returns the continuous data acquisition state.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

state

Variable Type int (passed by reference)

State

Queries run state of the instrument. Run indicates on-going continuous acquisition. Stop indicates that acquisitions are stopped.

Valid Values:
0 - ZT1428_STOP - Stopped
1 - ZT1428_RUN - Running

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_save_recall

```
int zt1428_save_recall (ViSession instrumentHandle, int setup,
                        int stateNumber);
```

Purpose

Save/Recall Setup

Saves or recalls the oscilloscope setup from/to non-volatile memory on the instrument.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

setup

Variable Type int

Setup

Defines the setup state operation to be performed. Save stores the current instrument settings to non-volatile memory. Recall loads a previously

saved instrument state from non-volatile memory.

Valid Range:
0 - ZT1428_SAVE - Save
1 - ZT1428_RCL - Recall

stateNumber

Variable Type int

State Number

Defines the setup state number to be saved or recalled from non-volatile memory.

Valid Range:
1 to 48

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_self_test

```
int zt1428_self_test (ViSession instrumentHandle, int *result);
```

Purpose

Self Test

Performs an instrument self test and returns the result.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

result

Variable Type int (passed by reference)

Result

Specifies the variable name in which to place the

result of the self test. If zero is returned, the self test passed.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_soft_trigger

```
int zt1428_soft_trigger (ViSession instrumentHandle);
```

Purpose

Soft Trigger

Causes a software-generated trigger event. This is useful when operating in triggered mode and the trigger source is not present.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_state_trigger

```
int zt1428_state_trigger (ViSession instrumentHandle, char logic[],
                          int source, int condition, int slope,
                          double levelChan1, double levelChan2,
                          double levelExt, int sensitivity1,
                          int sensitivity2);
```

Purpose

Set State Trigger

Configures the oscilloscope for state triggering.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

logic

Variable Type char []

Logic

This logic specifies the relationship between the signal and the defined voltage level that must exist before the pattern is considered valid. The logic pattern to be matched uses:
L to represent logic Low
H to represent logic High
X to represent Don't Care
A five-character string should be specified. The first character is for Channel 1, the second for Channel 2, the third for External, the fourth for ECLT0 and the last for ECLT1. The logic pattern for the selected state trigger source is ignored.

source

Variable Type int

Source

Specifies the source for the state trigger signal.

Valid Values:
1 - ZT1428_TRG_CHAN1 - Chan 1
2 - ZT1428_TRG_CHAN2 - Chan 2
3 - ZT1428_TRG_EXT - External
4 - ZT1428_TRG_ECL0 - ECL 0
5 - ZT1428_TRG_ECL0 - ECL 1

condition

Variable Type int

Condition

Selects the condition for the pattern that must be present while detecting an edge on the selected trigger source.

Valid Values:
0 - ZT1428_TRG_STAT_FALSE - False
1 - ZT1428_TRG_STAT_TRUE - True

slope

Variable Type int

Slope

Specifies the trigger slope for the specified state trigger source.

Valid Value:
0 - ZT1428_TRG_SLOPE_NEG - Negative slope
1 - ZT1428_TRG_SLOPE_POS - Positive slope

levelChan1

Variable Type double

Level Chan1

Specifies the trigger level of input channel 1 in Volts.

Valid Range:
ñ0.75 of the current voltage range from the current offset.

levelChan2

Variable Type double

Level Chan2

Specifies the trigger level of input channel 2 in Volts.

Valid Range:
ñ0.75 of the current voltage range from the current offset.

levelExt

Variable Type double

Level Ext

Specifies the trigger level of the external trigger input in Volts.

Valid Range:
-2.0V to +2.0V

sensitivity1

Variable Type int

Sensitivity1

Specifies the trigger filter mode for input channel 1. If Normal is selected, trigger filtering is turned off. If Low is selected, noise rejection hysteresis is enabled. If Low Freq Reject is selected, the trigger signal is AC coupled with a 50 kHz high-pass filter. If High Freq Reject is selected, the trigger signal is filtered with a 50 kHz low-pass filter.

Valid Range:
0 - ZT1428_TRG_SENS_NORM - Normal
1 - ZT1428_TRG_SENS_LOW - Low (Noise Reject)
2 - ZT1428_TRG_SENS_LFR - Low Freq Reject
3 - ZT1428_TRG_SENS_HFR - High Freq Reject

sensitivity2

Variable Type int

Sensitivity2

Specifies the trigger filter mode for input channel 2. If Normal is selected, trigger filtering is turned off. If Low is selected, noise rejection hysteresis is enabled. If Low Freq Reject is selected, the trigger signal is AC coupled with a 50 kHz high-pass filter. If High Freq Reject is selected, the trigger signal is filtered with a 50 kHz low-pass filter.

Valid Range:
0 - ZT1428_TRG_SENS_NORM - Normal
1 - ZT1428_TRG_SENS_LOW - Low (Noise Reject)
2 - ZT1428_TRG_SENS_LFR - Low Freq Reject
3 - ZT1428_TRG_SENS_HFR - High Freq Reject

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_store_waveform

```
int zt1428_store_waveform (ViSession instrumentHandle, int source,
                           int destination);
```

Purpose

Store Waveform to Memory

Stores waveform data from the specified input channel or math function to the specified waveform memory location.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

source

Variable Type int

Source

Specifies the source waveform to be stored. Valid sources include input channels, waveforms saved in memory, and math function waveforms.

Valid Values:
1 - ZT1428_CHAN1 - Channel 1
2 - ZT1428_CHAN2 - Channel 2
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4
7 - ZT1428_FUNC1 - Function 1
8 - ZT1428_FUNC2 - Function 2

destination

Variable Type int

Destination

Specifies the destination for the waveform to be stored.

Note: When storing in envelope acq. mode, the min. and max. waveforms are stored in two memories. For example, storing the wave to memory 1 will

place the min. waveform in memory 1 and the max. waveform in memory 2. Memories are grouped as 1 & 2, and 3 & 4. Selecting 1 or 2 has the same effect. Selecting 3 or 4 has the same effect.

Valid Values:
3 - ZT1428_WMEM1 - Memory 1
4 - ZT1428_WMEM2 - Memory 2
5 - ZT1428_WMEM3 - Memory 3
6 - ZT1428_WMEM4 - Memory 4

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_trigger_center

```
int zt1428_trigger_center (ViSession instrumentHandle, int source);
```

Purpose

Set Trigger to Offset

Configures the level of the selected trigger to its vertical center, which is equivalent to the DC offset for that selected source.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

source

Variable Type int

Source

Specifies the trigger source to center by setting its level at its DC offset setting.

Valid Values:
1 - ZT1428_TRG_CHAN1 - Chan 1
2 - ZT1428_TRG_CHAN2 - Chan 2

3 - ZT1428_TRG_EXT - External

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_trigger_event

```
int zt1428_trigger_event (ViSession instrumentHandle,
                          int *triggerEvent);
```

Purpose

Get Trigger Event

Returns the trigger event register status to indicate whether a trigger event has occured.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

triggerEvent

Variable Type int (passed by reference)

Trigger Event

Specifies the variable name in which to place the trigger event status. Reading the trigger event status clears the trigger event status.

Values Returned:
0 - No trigger Event
1 - Trigger Event Occurred.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

zt1428_trigger_holdoff

```
int zt1428_trigger_holdoff (ViSession instrumentHandle, int holdoffType,
                            int holdoffEvents, double holdoffTime);
```

Purpose

Set Trigger Holdoff

Sets the time or number of events to holdoff before detecting the trigger event.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

holdoffType

Variable Type int

Holdoff Type

Specifies the type of trigger holdoff.

Valid Values:
0 - ZT1428_TRG_HOLD_TIME - Time
1 - ZT1428_TRG_HOLD_EVENT - Event

holdoffEvents

Variable Type int

Holdoff Events

Specifies the holdoff by number of events.

Valid Values:
1 to 65536 events

holdoffTime

Variable Type double

Holdoff Time

Specifies the holdoff time in seconds.

Valid Values:
40 ns to 320 ms

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_tv_trigger

```
int zt1428_tv_trigger (ViSession instrumentHandle, int standard,
                       int field, int line, int slope, int source,
                       double level, int sensitivity);
```

Purpose

Set TV Trigger

Configures the oscilloscope for tv triggering.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

standard

Variable Type int

Standard

Specifies which TV standard to use.
525 - United States(60Hz) NTSC
625 - European(50Hz) PAL

Valid Range:
525 - ZT1428_TRG_TV_STAN_525 - NTSC
625 - ZT1428_TRG_TV_STAN_625 - PAL

field

Variable Type int

Field

Specifies the field for the standard video signal.
This determines the line availability.

Valid Range:
1 - ZT1428_TRG_TV_FIELD1 - Field 1
2 - ZT1428_TRG_TV_FIELD2 - Field 2

line

Variable Type int

Line

Specifies which line in the TV signal will
generate a trigger event.

Valid Range depends upon Standard and Field

Field	Standard	Range
1	525	1 to 263
2	525	1 to 262
1	625	1 to 313
2	625	314 to 625

slope

Variable Type int

Slope

Specifies the trigger slope for the specified
source.

Valid Value:
0 - ZT1428_TRG_SLOPE_NEG - Negative slope
1 - ZT1428_TRG_SLOPE_POS - Positive slope

source

Variable Type int

Source

Specifies the source for the trigger signal.

Valid Values:
1 - ZT1428_TRG_CHAN1 - Chan 1
2 - ZT1428_TRG_CHAN2 - Chan 2
3 - ZT1428_TRG_EXT - External
4 - ZT1428_TRG_ECL0 - ECL 0
5 - ZT1428_TRG_ECL0 - ECL 1

level

Variable Type double

Level

Specifies the trigger level of the selected source in Volts.

Valid Range:
ñ0.75 of the current voltage range from the current offset.

sensitivity

Variable Type int

Sensitivity

Specifies the trigger filter mode. If Normal is selected, trigger filtering is turned off. If Low is selected, noise rejection hysteresis is enabled. If Low Freq Reject is selected, the trigger signal is AC coupled with a 50 kHz high-pass filter. If High Freq Reject is selected, the trigger signal is filtered with a 50 kHz low-pass filter.

Valid Range:
0 - ZT1428_TRG_SENS_NORM - Normal
1 - ZT1428_TRG_SENS_LOW - Low (Noise Reject)
2 - ZT1428_TRG_SENS_LFR - Low Freq Reject
3 - ZT1428_TRG_SENS_HFR - High Freq Reject

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_vertical

```
int zt1428_vertical (ViSession instrumentHandle, int channel,
                     int coupling, int lowpassFilter,
                     double probeAttenuation, double range,
                     double offset);
```

Purpose

Set Vertical

Configures the vertical settings for the selected channel(s).

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle returned by the Initialize function to select the desired instrument.

channel

Variable Type int

Channel

Selects the channel to be configured.

Valid Range:
1 - ZT1428_CHAN1   - Channel 1
2 - ZT1428_CHAN2   - Channel 2
10 - ZT1428_CHAN_BOTH - Channels 1 & 2

coupling

Variable Type int

Coupling

Sets the input coupling for the selected channel. The coupling for each channel can be set to AC, DC, or DCFifty, or ACLFR. DCFifty is DC coupling with 50 ohm impedance. ACLFR is AC coupling which also selects an internal high pass filter to reject frequencies below approximately 450Hz.

Valid Range:
0 - ZT1428_VERT_COUP_AC   - AC 1Mê (10 Hz)
1 - ZT1428_VERT_COUP_ACLFR - AC 1Mê (450 Hz)
2 - ZT1428_VERT_COUP_DC   - DC 1Mê
3 - ZT1428_VERT_COUP_DCF   - DC 50ê

lowpassFilter

Variable Type int

Lowpass Filter

Selects which lowpass filter, if any, will be used. When OFF, the lowpass filter is bypassed, providing approximately 250 MHz bandwidth. The bandwidth limit filter may be used with all coupling selections.

Valid Range:
0 - ZT1428_VERT_FILT_OFF   - Off
1 - ZT1428_VERT_FILT_30MHZ - 30 MHz Lowpass Filter
2 - ZT1428_VERT_FILT_1MHZ - 1 MHz Lowpass Filter

probeAttenuation

Variable Type double

Probe Attenuation

Specifies the probe's attenuation factor for the specified channel. The probe attenuation changes the reference constants for scaling the vertical range and offset, automatic measurements, trigger levels, etc.

Valid Range:
0.9 to 1000.0

range

Variable Type double

Range

Specifies the full scale acquisition range in volts for the specified input channel.

Valid Range depends upon probe attenuation (P):
(0.008 * P) to (50 * P)
with (0.008 * P) resolution

offset

Variable Type double

Offset

Specifies the DC offset voltage that is represented at vertical center for the selected channel.

Valid Range depends upon range and probe attenuation (P):

Channel range	Offset Limit
8mV * P to 400mV * P	ñ2V * P
> 400mV * P to 2.0V * P	ñ10V * P
> 2.0V * P to 10.0V * P	ñ50V * P
> 10.0V * P to 50.0V * P	ñ250V * P

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_wait_op_complete

```
int zt1428_wait_op_complete (ViSession instrumentHandle);
```

Purpose

Get Operation Complete

Returns the instrument operation complete status.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

Return Value

Control Name: Error

Description: Displays status relating to the function call.

---

zt1428_width_parameters

```
int zt1428_width_parameters (ViSession instrumentHandle,
                             int positiveWidthLevel,
                             int negativeWidthLevel);
```

Purpose

Set Width Parameters

Sets the level conditions for positive width and negative width measurements.

Parameter List

instrumentHandle

Variable Type ViSession

Instrument Handle

Accepts the Instrument Handle, returned by the Initialize function, to select the desired instrument.

positiveWidthLevel

Variable Type int

Positive Width Level

Specifies the level for the positive pulse width measurements.

Valid Values:
0 - ZT1428_DEL_LEV_LOW - Lower
1 - ZT1428_DEL_LEV_MID - Middle
2 - ZT1428_DEL_LEV_UPP - Upper

negativeWidthLevel

Variable Type int

Negative Width Level

Specifies the level for the negative pulse width measurements.

Valid Values:
0 - ZT1428_DEL_LEV_LOW - Lower
1 - ZT1428_DEL_LEV_MID - Middle
2 - ZT1428_DEL_LEV_UPP - Upper

Return Value

Control Name: Error

Description: Displays status relating to the function call.