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Verification Script Engine

for

LeCroy PE*Tracer*

Reference Manual

Manual Version 1.1
For PETracer Software Version 4.50

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Version

This is version 1.1 the PETracer Verification Script Engine Reference Manual. This manual applies to PETracer software version 4.50 and higher.

Table of Contents

1 Introduction

This document contains a description of the LeCroy Verification Script Engine (VSE), a new utility in the PETracer software that allows users to perform custom analyses of PCI Express (PE) traffic, recorded using the new generation of PCI Express protocol analyzers.

VSE allows users to ask the PETracer application to send some desired "events" (currently defined as packets, link transactions or split transactions) from a PE trace to a verification script written using the CATC script language. This script then evaluates the sequence of events (timing, data or both) in accordance with user-defined conditions and performs post-processing tasks; such as exporting key information to external text-based files or sending special Automation/COM notifications to user client applications.

VSE was designed to allow users to easily retrieve information about any field in a PE packet header or link/split transaction, and to make complex timing calculations between different events in a pre-recorded trace. It also allows filtering-in or filtering-out of data with dynamically changing filtering conditions, porting of information to a special output window, saving of data to text files, and sending of data to COM clients connected to a PETracer application.

2 Verification Script Structure

Writing a verification script is easy, as long as you follow a few rules and have some understanding of how the PETracer application interacts with running scripts.

The main script file that contains the text of the verification script should have extension *.pevs*, and be located in the subfolder *..\Scripts\VFScripts* of the main PETracer folder. Some other files might be included in the main script file using directive *%include*. (see the LeCroy PETracer File Based Decoding user manual for details).

The following schema presents a common structure of a verification script (this is similar to the content of the script template [*VSTemplate.pev_*] which is included with VSE):

```
#
#
#   VS1.pevs
#
#   Verification script
#
#   Brief Description:
#   Performs specific verification
#


##############################################################################################
#  Module info
##############################################################################################
#  Filling of this block is necessary for proper verification script operation...
##############################################################################################
set ModuleType  = "Verification Script";            # Should be set for all verification scripts
set OutputType  = "VS";                             # Should be set for all verification scripts that
                                                    # output only Report string and Result.
set InputType   = "VS";

set DecoderDesc = "<Your Verification Script description>"; # Optional

##############################################################################################################
#
# include main Verification Script Engine definitions
#
%include  "VSTools.inc"                              # Should be set for all verification scripts


##############################################################################
#                           Global Variables and Constants
##############################################################################

# Define your verification script-specific global variables and constant in this section...
# (Optional)

    const MY_GLOBAL_CONSTANT = 10;
    set g_MyGlobalVariable   = 0;


##############################################################################


##############################################################################
#   OnStartScript()
##############################################################################
#
#        It is a main intialization routine for setting up all necessary
#        script parameters before running the script.
#
```

```
##############################################################################


OnStartScript()
{
  ###########################################################################################
  # Specify in the body of this function the initial values for global variables
  # and what kinds of trace events should be passed to the script.
  # ( By default, all packet level events from all channels
  #  will be passed to the script.
  #
  #  For details - how to specify what kind of events should be passed to the script
  #  please see the topic 'sending functions'.
  #
  #  OPTIONAL.
  ###########################################################################################


   g_MyGlobalVariable   = 0;

    # Uncomment the line below - if you want to disable output from
    # ReportText()-functions.
    #
    # DisableOutput();
}



##############################################################################
#   ProcessEvent()
##############################################################################
#
#
##############################################################################
# It is a main script function called by the application when the next waited event
# occured in the evaluated trace.
#
# !!! REQUIRED !!! - MUST BE IMPLEMENTED IN VERIFICATION SCRIPT
##############################################################################

ProcessEvent()
{

    #  Write the body of this function depending upon your needs.
    #  It might require branching on event type:
    # select {
    #   in. TraceEvent == … : …
    #   in. TraceEvent == … : …
    #  …
    # }

    return Complete();
}



##############################################################################
#   OnFinishScript()
##############################################################################
#
##############################################################################
# It is a main script function called by the application when the script completed
# running. Specify in this function some resetting procedures for a successive run
# of this script.
#
#  OPTIONAL.
##############################################################################
OnFinishScript()
{
    return 0;
}


##############################################################################
```

```
################################################################################
#   Additional script functions.
################################################################################
#
# Write your own script-specific functions here...
#
################################################################################
MyFunction( arg )
{
        if( arg == "My Arg" ) return 1;
        return 0;
}
```

3 Interaction between PETracer and a verification script

When a user runs a script against a pre-recorded trace, the following sequence occurs:

1. Prior to sending information to the script's main processing function *ProcessEvent()*, VSE looks for the function *OnStartScript()* and calls it if it is found. In this function, setup actions are defined, such as specifying the kind of trace events that should be passed to the script and setting up initial values for script-specific global variables.

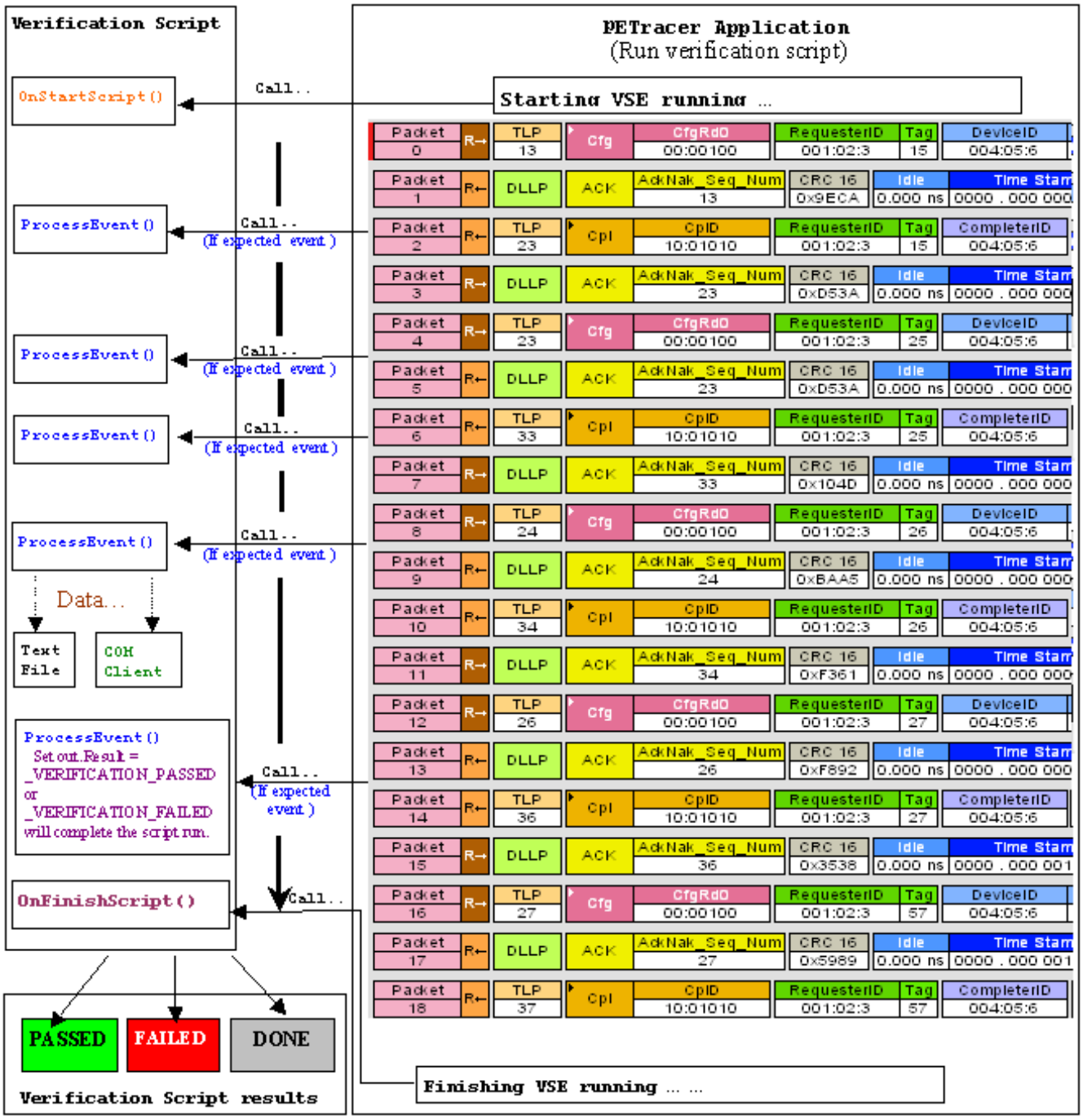
2. Next, the VSE parses the recorded trace to verify that the current packet or other event meets specific criteria – if it does, VSE calls the script's main processing function *ProcessEvent()*, placing information about the current event in the script's input context variables.
   (Please refer to the topic *Input context variables* later in this document for a full description of verification script input context variables)

3. *ProcessEvent()* is the main verification routine for processing incoming trace events. This function must be present in all verification scripts. When the verification program consists of a few stages, the *ProcessEvent()* function processes the event sent to the script, verifies that information contained in the event is appropriate for the current stage, and decides if VSE should continue running the script or, if the whole result is clear on the current stage, tell VSE to complete execution of the script.
   The completion of the test before the entire trace has been evaluated is usually done by setting the output context variable in this manner: *out.Result = _VERIFICATION_PASSED* or *_VERIFICATION_FAILED*.
   (Please refer to the topic *Output context variables* later in this document for a full description of verification script output context variables)

   NOTE: Not only does a verification script evaluate recorded traces against some criteria - but it can also extract information of interest and post-process it later by some third-party applications (there is a set of script functions allowing you to save extracted data in text files, or send it to other applications, via COM/Automation interfaces).

4. When the script has completed running, VSE looks for the function *OnFinishScript()* and calls it if found. In this function, some resetting procedures can be done.

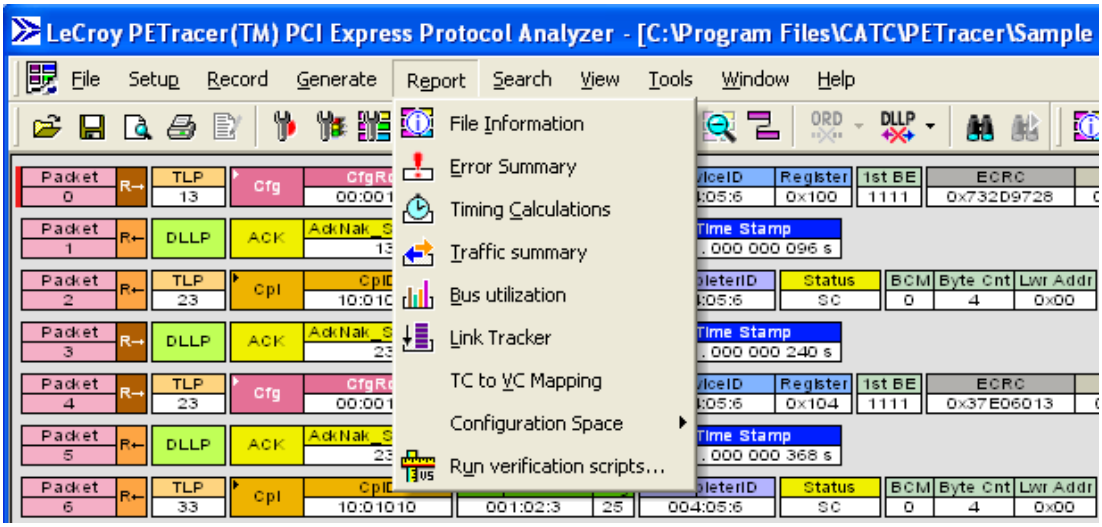
The following figure illustrates the interaction between the PETracer application and a running verification script:



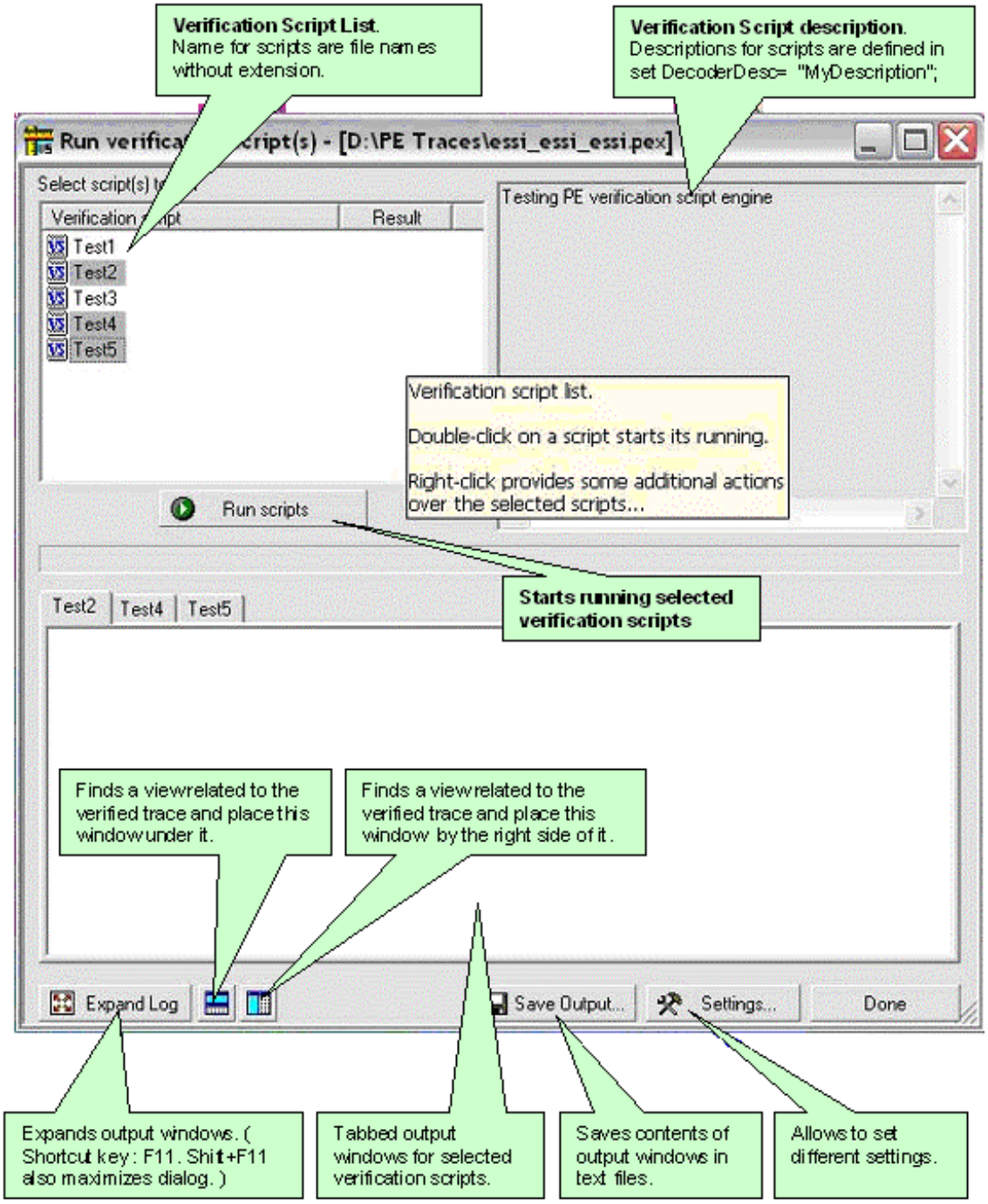
The Verification script result "DONE" occurs when the script has been configured to extract and display some information about the trace, but not to display PASSED/FAILED results. To configure a script so that it only displays information – place a call somewhere in your script to the function *ScriptForDisplayOnly()*in *OnStartScript()*, for example.

4 Running verification scripts from the PETracer

In order to run a verification script over a trace - you need to open the PETracer main menu item *Report\Run verification scripts…* or push the icon on the main toolbar if it is not hidden.

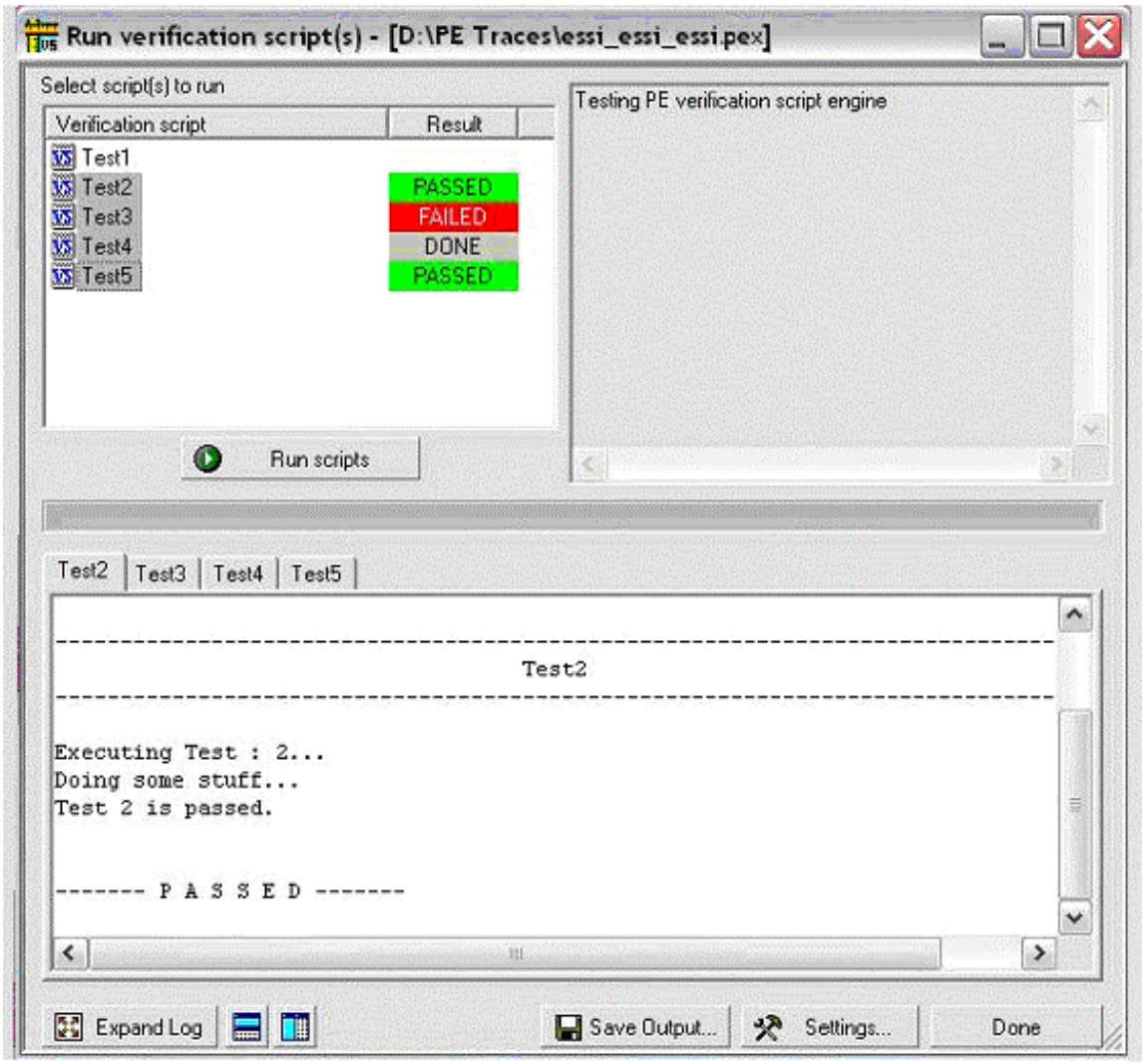


The special dialog will open displaying a list of verifications scripts. You can select one script to run, or several scripts from the list to run in parallel:

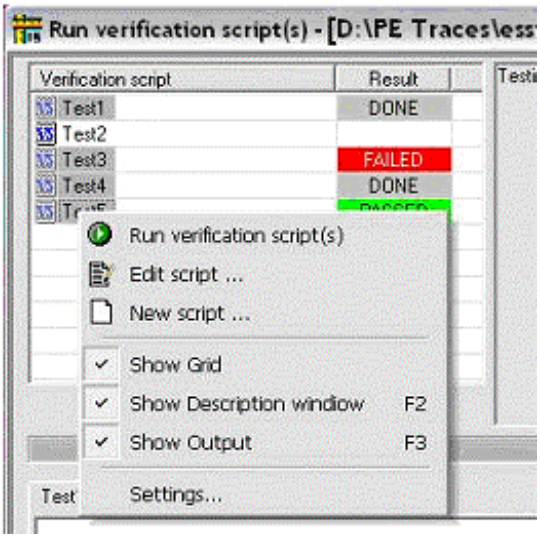


4.1 Running verification scripts

Push the button *Run scripts* after you selected the desired script(s) to run. VSE will start running the selected verification script(s), show script report information in the output windows, and present results of verifications in the script list:



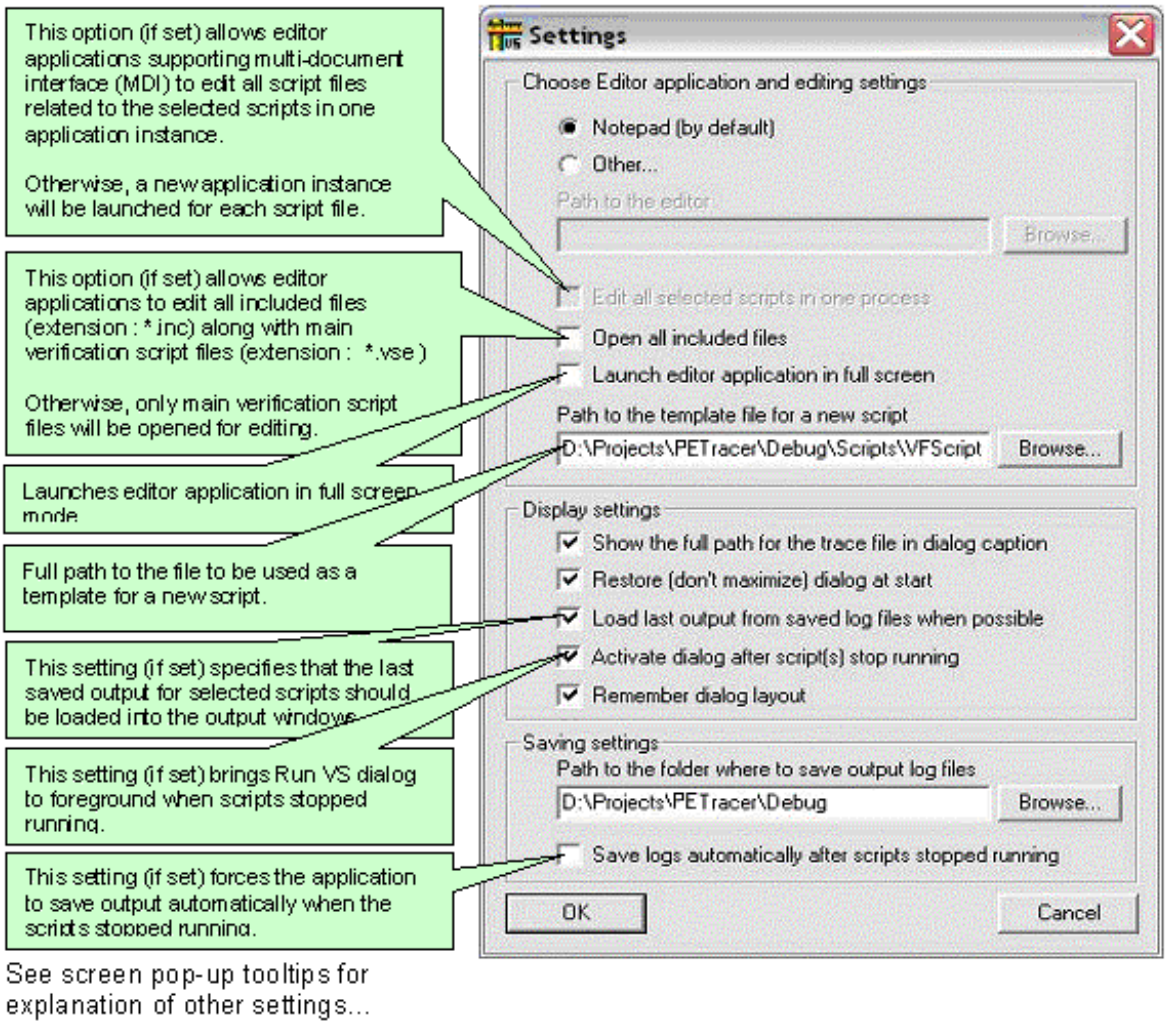
Right-click in script list opens a pop-up menu with options for performing additional operations on the selected scripts:



- ***Run verification script(s)*** – starts running selected script(s)
- ***Edit script*** – allows editing of the selected script(s) using whatever editor was specified in *Editor settings*
- ***New script*** – creates a new script file using the template specified in *Editor settings*.
- ***Show Grid*** – shows/hides a grid in the verification script list**.**
- ***Show Description window*** – shows/hides the script description window**. (Shortcut key : F2)**
- ***Show Output*** - shows/hides the script output windows. **(Shortcut key : F3)**
- ***Settings*** – opens a special *Setting* dialog which allows you to specify different settings for VSE.

4.2 VSE GUI settings.

After choosing *Settings,* the following dialog will appear:



5 Verification Script Engine Input Context members

All verification scripts have input contexts – some special structures whose members are filled by the application and can be used inside of the scripts (for more details about input contexts – please refer to the *CATC Script Language(CSL) Manual*). The verification script input contexts have two sets of members:

- Trace event-independent set of members.
- Trace event -dependent set of members.

5.1 Trace event-independent set of members

This set of members is defined and can be used for any event passed to script:

in.Level - transaction level of the trace event (0 = frames, 1= sequences)

in.Index - Index of the event in the trace file (frame number for frames, sequence number for sequences)

in.Time - time of the event (type: list, having the format: 2 sec 125 ns -> [2 , 125]. (See *9.1 VSE time object* for details)

in.Channel - channel where the event occured. (may be *_CHANNEL_1 (1)* or *_CHANNEL_2 (2)* indicating which direction of the PE link the event occurred)

in.TraceEvent - type of trace event (application predefined constants are used. See the list of possible events, below)

in.Notification - type of notification (application predefined constants are used. Currently, no notifications are defined)

5.2 Trace event-dependent set of members

This set of members is defined and can be used only for a specific events or after calling some functions filling out some of the variables:

5.2.1 All packet/transaction-specific set of members

Members of this set are valid for any event.

in.Payload - bit source of the frame/sequence payload (you can extract any necessary information using *GetNBits()*, *NextNBits()*, or *PeekNBits()* functions – please refer to the *CSL Manual* for details about these functions)

in.PayloadLength - the length (in bytes of the retrieved payload)

in.LinkWidth – the Link Width recorded for this packet. Possible values – 1, 2, 4, 8, 16 -- represent the number of lanes on the link.

Error-related variables. Used for passing all the detected packet error types to the script.

in.HasErrors – indicates presence of any error type in the current packet. If this variable is set to 1, some of the errors described below are specified. If it is set to zero, no errors are present.
in.ErrorDisparity – if set to a non-zero value, indicates presence of Running Disparity error(s) in this packet
in.ErrorSymbol – if set to a non-zero value, indicates presence of Symbol (10-bit Code) error(s) in this packet
in.ErrorDelimiter – if set to a non-zero value, indicates presence of Delimiter error(s) in this packet
in.ErrorEndBad – if set to a non-zero value, indicates presence of an EDB symbol in this packet
in.ErrorAlignment – if set to a non-zero value, indicates presence of Alignment error(s) in this packet
in.ErrorLength – if set to a non-zero value, indicates presence of Bad Length error(s) in this TLP packet

in.HasIdleErrors – indicates presence of Idle errors in the current packet. If set, one of the following is set, indicating the presensef of error(s) of this type between this packet and the previous packet on this direction of the link:
in.IdleErrorDisparity – if set to a non-zero value, indicates presence of Running Disparity error(s)
in.IdleErrorSymbol – if set to a non-zero value, indicates presence of Symbol (10-bit Code) error(s)
in.IdleErrorSkip – if set to a non-zero value, indicates presence of Skip error(s)
in.IdleErrorData – if set to a non-zero value, indicates presence of Logical Idle data pattern error(s)

Note: for CRC error variables, see the specific packet type variable sets below.

5.2.2 DLLP-specific set of members

(valid for data link layer packets only, undefined for other events)

in.DLLPType – contains the numeric encoding of the DLLP type. The following possible values are defined by VSE and the corresponding constants can be used by scripts:

```
DLLP_TYPE_ACK                    = 0x0;
DLLP_TYPE_NAK                    = 0x1;
DLLP_TYPE_INIT_FC1_P             = 0x4;
DLLP_TYPE_INIT_FC1_NP            = 0x5;
DLLP_TYPE_INIT_FC1_CPL           = 0x6;
DLLP_TYPE_INIT_FC2_P             = 0xC;
DLLP_TYPE_INIT_FC2_NP            = 0xD;
DLLP_TYPE_INIT_FC2_CPL           = 0xE;
DLLP_TYPE_UPDATE_FC_P            = 0x8;
DLLP_TYPE_UPDATE_FC_NP           = 0x9;
DLLP_TYPE_UPDATE_FC_CPL          = 0xA;
DLLP_TYPE_VENDOR                 = 0x3;

DLLP_TYPE_PM_ENTER_L1            = 0x10;
DLLP_TYPE_PM_ENTER_L23           = 0x11;
DLLP_TYPE_PM_ACT_STATE_REQUEST_L1 = 0x13;
DLLP_TYPE_PM_REQUEST_ACK         = 0x14;

DLLP_TYPE_INVALID                = 0x7;
```

in.AckNak_SeqNum – field value (valid only for *Ack* and *Nak* DLLPs), indicating which TLPs are affected by the acknowledgement

in.VC_ID – Virtual Channel ID (valid only for *InitFC* and *UpdateFC* DLLPs)

in.HdrFC – credit value for headers of the type indicated by the DLLP type (valid only for *InitFC* and *UpdateFC* DLLPs)

in.DataFC – credit value for payload data of the type indicated by the DLLP type (valid only for *InitFC* and UpdateFC DLLPs)

in.VendorSpecific – The 3-byte vendor-defined value in a *Vendor-specific* DLLP

in.BadCRC – Set to 1 if the DLLP has bad 16-bit CRC, to 0 otherwise

5.2.3 TLP-specific set of members

Valid for TLPs only, undefined for other events.

All TLPs:

in.TLPType – contains the numeric encoding of the TLP type. The following possible values are defined by VSE and the corresponding constants can be used by scripts:

```
TLP_TYPE_ID_INVALID = 0;
TLP_TYPE_ID_MRD32   = 1;
TLP_TYPE_ID_MRDLK32 = 2;
TLP_TYPE_ID_MWR32   = 3;
TLP_TYPE_ID_MRD64   = 4;
TLP_TYPE_ID_MRDLK64 = 5;
TLP_TYPE_ID_MWR64   = 6;
TLP_TYPE_ID_IORD    = 7;
TLP_TYPE_ID_IOWR    = 8;
TLP_TYPE_ID_CFGRD_0 = 9;
TLP_TYPE_ID_CFGWR_0 = 10;
TLP_TYPE_ID_CFGRD_1 = 11;
TLP_TYPE_ID_CFGWR_1 = 12;
TLP_TYPE_ID_MSG     = 13;
TLP_TYPE_ID_MSGD    = 14;
TLP_TYPE_ID_MSGAS   = 15;
TLP_TYPE_ID_MSGASD  = 16;
TLP_TYPE_ID_CPL     = 17;
TLP_TYPE_ID_CPLD    = 18;
TLP_TYPE_ID_CPLLK   = 19;
TLP_TYPE_ID_CPLDLK  = 20;
```

in.BadLCRC – Set to 1 if the TLP has bad LCRC, to 0 otherwise
in.BadECRC – Set to 1 if the TLP has bad ECRC (when it should be present), to 0 otherwise

Field values for all TLP types:

in.Type – Type of TLP field value
in.Fmt – Format of TLP field value
in.PSN – Packet Sequence Number for this TLP as set by the Data Link Layer
in. RequesterId – Requester ID value (Bus, Device and Function Number fields combined)
in.Tag – Tag field value
in.TC – Traffic Class field value
in.Length – Length field value
in.Snoop – Snoop attribute bit value
in.Ordering – Ordering attribute bit value
in.TD – TLP Digest bit value
in.EP – Poisoned TLP bit value
in.LCRC – LCRC value as set by the Data Link Layer
in.ECRC – ECRC value (optional)

Field values dependant upon TLP type:

in.FirstDwBe – Byte Enable bits for the first DW of the payload (all TLPs except Completions and Messages)
in.LastDwBe – Byte Enable bits for the last DW of the payload (all TLPs except Completions and Messages)

in.Address – 32-bit Address value for IO, Configuration, and Mem-32 requests
in.AddressLo – Low 32 bits of the Address for Mem-64 requests and Messages routed by address
in.AddressHi – High 32 bits of the Address for Mem-64 requests and Messages routed by address

in.DeviceId – Requester ID value (Bus, Device and Function Number fields combined) for Configuration requests and Messages routed by ID
in.Register – Register address (Register Number and Extended Register Number combined) for Configuration requests

For Completion TLPs only:

in.CompleterId – Completer ID value (Bus, Device and Function Number fields combined)
in.ComplStatus – Completion Status field value
in.BCM – Byte Count Modified bit value
in.ByteCount – Remaining Byte Count field value
in.LowerAddr – Lower Address for starting byte of completion field value

For Message TLPs only:

in.MessageCode – Message Code field value
in.MessageRoute – Message Routing field value (from the TLP Type field)

For Configuration Write Requests and Read Completions:

in.RegisterData – The 32-bit value written to or read from a configuration register (for convenience of processing the configuration requests, as it also can be obtained from the Payload)

5.2.4 Ordered Set specific set of members

in.OrderedSetType – contains the numeric encoding of the Ordered Set type. The following possible values are defined by VSE and the corresponding constants can be used by scripts:

```
ORDSET_TYPE_TS1      = 0x02;
ORDSET_TYPE_TS2      = 0x03;
ORDSET_TYPE_FTS      = 0x04;
ORDSET_TYPE_IDLE_SET = 0x05;
ORDSET_TYPE_SKIP     = 0x07;
ORDSET_TYPE_PATN     = 0x08;
```

For Training Sequences (TS1 and TS2), the following variables of the list type exist in the input context (the lists are arrays of integers with dimensions equal to the Link Width for the Training Sequence packet).

in.TS_LinkNumberList – contains the Link Number parameter values for all lanes
in.TS_LaneNumberList – contains the Lane Number parameter values for all lanes
in.TS_N_FTSList – contains the N_FTS parameter values for all lanes
in.TS_TrainingControlList – contains the Training Control bitmap parameter values for all lanes

Note: For Link Number and Lane Number values the special value of 0x1FF is used to indicate the PAD symbol. Please refer to the *examp_ordered_sets.pevs* sample script for an example of how to process ordered Sets and Training Sequences in particular.

5.2.5 Link Condition specific set of members

in.LinkConditionType – contains the numeric encoding of the Link Condition type. The following possible values are defined by VSE and the corresponding constants can be used by scripts:

LINK_CONDITION_LINK_UP = 1; - A “Link Up” Link Condition event
LINK_CONDITION_LINK_DOWN = 2; - A “Link Down” Link Condition event
LINK_CONDITION_SKEW = 3; - A “Deskewing” Link Condition event
LINK_CONDITION_ELECTR_IDLE = 4; - An “Electrical Idle” Link Condition event

5.2.6 Link transaction-specific set of members

Valid for Link transactions only, undefined for other events.

All the TLP-specific values are present in the input context for Link transactions, depending upon the type of TLP for this Link transaction. In addition to that, the following value exists:

in.TransactionStatus – Status for this Link transaction. Can be one of three values: Implicitly Acknowledged, Explicitly Acknowledged, or Incomplete (Link Layer error). See file *VS_constants.inc* for encodings.

Metric values.
The following values are defined in input context for Link Transactions that are related to Unit Metrics. To learn more about Unit Metrics please refer to PETracer Help.

in.Metric_NumOfPackets – Metric presenting the total number of packets that compose this Link Transaction, an integer value;
in.Metric_ResponseTime – Metric presenting time it took to transmit this Link Transaction on the PE link, from the beginning of the first packet in the transaction to the end of the last packet in the transaction, a VSE time object value (See *9.1 VSE time object* for details);
in.Metric_Throughput – Metric presenting transaction payload divided by response time, expressed in **kilobytes** per second, an integer value;
in.Metric_PayloadBytes – Metric presenting number of data payload bytes this Link Transaction transferred, an integer value.

Note: for the incomplete Link Transactions only the NumOfPackets metric is valid. In case of an incomplete Link Transaction the ResponseTime metric value will be set to `null`.

5.2.7 Split transaction-specific set of members

Valid for Split transactions only, undefined for other events.

All the TLP-specific values **for the request TLP of the split transaction** are present in the input context for Link transactions, depending upon the type of TLP for this Link transaction. Also the common PayloadLength and Payload values will reflect the total combined payload for the Split transaction. In addition to that, the following values exist:

in.CompletionStatus – Completion Status for this Split transaction. From the last completion of the response.

Metric values.
The following values are defined in input context for Split Transactions that are related to Unit Metrics. To learn more about Unit Metrics please refer to PETracer Help.

in.Metric_NumOfPackets – Metric presenting the total number of packets that compose this Link Transaction, an integer value;
in.Metric_ResponseTime – Metric presenting time it took to transmit this Split Transaction on the PE link, from the beginning of the first packet in the transaction to the end of the last packet in the transaction, a VSE time object value (See *9.1 VSE time object* for details);
in.Metric_LatencyTime – Metric presenting time measured from the end of the request transaction to the first completion transmitted in response to the request within this Split Transaction, a VSE time object value (See *9.1 VSE time object* for details);
in.Metric_Throughput – Metric presenting transaction payload divided by response time, expressed in **kilobytes** per second, an integer value;
in.Metric_PayloadBytes – Metric presenting number of data payload bytes this Split Transaction transferred, an integer value.

Note: for the incomplete Link Transactions only the NumOfPackets metric is valid. In case of an incomplete Link Transaction the ResponseTime metric value will be set to `null`.

6 Verification Script Engine Output Context members

All verification scripts have output contexts – some special structures whose members are filled by the script and can be used inside of the application (for more details about output contexts – please refer to the *CATC Script Language(CSL) Manual*). The verification script output contexts have only one member:

out.Result - the result of the whole verification program defined in the verification script.

This member is supposed to have 3 values:
_VERIFICATION_PROGRESS,(is set by default when script starts running)
_VERIFICATION_PASSED, and ***_VERIFICATION_FAILED***

The last two values should be set if you decide that recorded trace does (or does not) satisfy the imposed verification conditions. In both cases, the verification script will stop running.

If you don't specify any of those values - the result of script execution will be set as *_VERIFICATION_FAILED* at exit.

NOTE: If you don't care about the results of the script that's running, please call function *ScriptForDisplayOnly()* one time before stopping the script – then the results will be *DONE*.

7 Verification Script Engine events

VSE defines a large group of trace "events" – on packet, link and split transaction levels – that can be passed to a verification script for evaluation or retrieving and displaying some contained information. The information about the type of event can be seen in *in.TraceEvent*. Please refer to the topic *Sending functions* in this manual for details about how to specify transaction levels and which events should be sent to verification scripts.

7.1 Packet level events

The table below describes the current list of packet level events (transaction level: 0) and value of *in.TraceEvent*:

Types of packets	**in.TraceEvent**
Data Link Layer Packets (DLLP)	_PKT_DLLP
Transaction Layer Packets (TLP)	_PKT_TLP
Ordered Sets	_PKT_ORDERED_SET
Link Conditions	_PKT_LINK_CONDITION

7.2 Link Transaction level events

The table below describes the current list of Link Transaction events (transaction level: 1) and value of *in.TraceEvent*:

Types of Link Transactions	**in.TraceEvent**
Memory transactions	_LINK_MEMORY
IO transactions	_LINK_IO
Configuration transactions	_LINK_CONFIG
Message transactions	_LINK_MESSAGE
Completion transactions	_LINK_COMPLETION

7.3 Split Transaction level events

The table below describes the current list of Split Transaction events (transaction level: 2) and value of *in.TraceEvent*:

Types of Split Transactions	**in.TraceEvent**
Memory transactions	_SPLIT_MEMORY
IO transactions	_SPLIT_IO
Configuration transactions	_SPLIT_CONFIG

8 Sending functions

This topic contains information about the special group of VSE functions designed to specify which events the verification script should expect to receive.

8.1 SendLevel()

This function specifies that events of the specified transaction level should be sent to the script.

Format : **SendLevel(*level*)**

Parameters: *level* – This parameter can be one of following values:

_PACKET	– (value 0) send Packet level events
_LINK	– (value 1) send Link Transaction level events
_SPLIT	– (value 2) send Split Transaction level events

Note: only Packet and Link Transaction level events are available in release 4.4 of PETracer software.

Example:

```
…
SendLevel( _PACKET);  # - send packet level events
```

Remark:

If no level was specified – events of packet level will be sent to the script by default.

8.2 SendLevelOnly()

This function specifies that ONLY events of the specified transaction level should be sent to the script.

Format : **SendLevelOnly(*level*)**

Parameters: *level* – This parameter can be one of following values:

_PACKET	– (value 0) send Packet level events
_LINK	– (value 1) send Link Transaction level events
_SPLIT	– (value 2) send Split Transaction level events

Example:

```
…
SendLevelOnly( _PACKET ); # - send ONLY packet level events
```

8.3 DontSendLevel()

This function specifies that events of the specified transaction level should NOT be sent to the script.

Format : **DontSendLevel(*level*)**

Parameters: *level* – This parameter can be one of following values:

_PACKET – (value 0) send Packet level events
_LINK – (value 1) send Link Transaction level events
_SPLIT – (value 2) send Split Transaction level events

Example:

```
…
DontSendLevel( _LINK); # - DO NOT send link transaction level events
```

8.4 SendChannel()

This function specifies that events that have occurred on the specified channel should be sent to script.

Format : **SendChannel(*channel*)**

Parameters: *channel* – This parameter can be one of following values:

_CHANNEL_1 (= 1) – send events from Upstream direction of the link (channel 1)
_CHANNEL_2 (= 2) – send events from Downstream direction of the link (channel 2)

Example:

```
…
SendChannel(_CHANNEL_1); # - send events from Upstream direction of the link
```

8.5 SendChannelOnly()

This function specifies that ONLY events that have occurred on the specified channel should be sent to the script.

Format : **SendChannelOnly(*channel*)**

Parameters: *channel* – This parameter can be one of following values:

_CHANNEL_1 (= 1) – send events from Upstream direction of the link (channel 1)
_CHANNEL_2 (= 2) – send events from Downstream direction of the link (channel 2)

Example:

```
…
SendChannelOnly( _CHANNEL_1 );  # - send ONLY events from Upstream direction
of the link
```

8.6 DontSendChannel ()

This function specifies that events that have occurred on the specified channel should NOT be sent to the script.

Format : **DontSendChannel (*channel*)**

Parameters: *channel* – This parameter can be one of following values:

_CHANNEL_1 (= 1) – send events from Upstream direction of the link (channel 1)
_CHANNEL_2 (= 2) – send events from Downstream direction of the link (channel 2)

Example:

```
…
DontSendChannel ( _CHANNEL_1 );  # - DO NOT send events from Upstream
direction of the link
```

8.7 SendAllChannels()

This function specifies that events that have occurred on ALL channels should be sent to the script.

Format : **SendAllChannels ()**

Example:

```
…
SendAllChannels ();  # - send events from ALL channels
```

8.8 SendTraceEvent ()

This function specifies the events to be sent to the script.

Format : **SendTraceEvent(*event*)**

Parameters: *event* – This parameter may be one of the following values:

Packet level events:

event value	Description
_PKT_DLLP	Data Link Layer Packets (DLLP)
_PKT_TLP	Transaction Layer Packets (TLP)
_PKT_ORDERED_SET	Ordered Sets
_PKT_LINK_CONDITION	Link Conditions

Link Transaction level events:

event value	Description
_LINK_MEMORY	Memory transactions
_LINK_IO	IO transactions
_LINK_CONFIG	Configuration transactions
_LINK_MESSAGE	Message transactions
_LINK_COMPLETION	Completion transactions

Example:

```
…
SendTraceEvent( _PKT_TLP );
…

SendLevel( _LINK );
SendTraceEvent ( _LINK_MEMORY ); # - send memory Read and Write request
transactions to the script
```

8.9 DontSendTraceEvent()

This function specifies that the event specified in this function should not be sent to script.

Format : **DontSendTraceEvent (*event*)**

Parameters: *event* – See *SendTraceEvent ()* for all possible values.

Example:

```
…
SendLevel( _LINK );                 # Send Link Transaction level events
SendTraceEvent ( _LINK_CONFIG );    # Send Configuration  transactions
```

```
      SendTraceEvent ( _LINK_COMPLETION  );  # Send Completion transactions
      SendTraceEvent ( _LINK_MESSAGE  );  # Send Message transactions
      …
      if( SomeCondition )
      {
            DontSendTraceEvent (_LINK_CONFIG);   # Don't send Cfg Request
transactions
            DontSendTraceEvent (_LINK_COMPLETION);  # Don't send Completion
transactions

            # Only Message transactions will be sent.
      }
```

8.10 SendTraceEventOnly()

This function specifies that ONLY the event specified in this function will be sent to the script.

Format : **SendTraceEventOnly(*event*)**

Parameters: *event* – See *SendTraceEvent ()* for all possible values.

Remark: This function may be useful when many events are to be sent, yet you need to send only one kind of event and turn off the rest.

Example:

```
      …
      SendLevel( _LINK );                  # Send Link Transaction level events
      SendTraceEvent ( _LINK_CONFIG );     # Send Configuration  transactions
      SendTraceEvent ( _LINK_COMPLETION  );  # Send Completion transactions
      SendTraceEvent ( _LINK_MESSAGE  );  # Send Message transactions
      …
      if( SomeCondition )
      {
            SendTraceEventOnly (_LINK_MEMORY );
            # Only Memory read/write request transactions will be sent.
      }
```

8.11 SendAllTraceEvents()

This function specifies that ALL trace events relevant for the selected transaction level will be sent to the script.

Format : **SendAllTraceEvents ()**

Example:

```
      …
      SendLevel( _PACKET );    # Send packet level events
      SendAllTraceEvents ( );     # All TLP, DLLP and Ordered Set packets will be
sent to the script
```

8.12 SendDllpType()

This function specifies more precise tuning (filtering in) for sending DLLP packets to the script.

Format : **SendDllpType(*dllp_type*)**

Parameters:

dllp_type – encoding of the DLLP type. This parameter may be one of the following values:

DLLP type values:

Constant	DLLP type
_DLLP_TYPE_ACK	Ack
_DLLP_TYPE_NAK	Nak
_DLLP_TYPE_INIT_FC1_P	InitFC1-P
_DLLP_TYPE_INIT_FC1_NP	InitFC1-NP
_DLLP_TYPE_INIT_FC1_CPL	InitFC1-Cpl
_DLLP_TYPE_INIT_FC2_P	InitFC2-P
_DLLP_TYPE_INIT_FC2_NP	InitFC2-NP
_DLLP_TYPE_INIT_FC2_CPL	InitFC2-Cpl
_DLLP_TYPE_UPDATE_FC_P	UpdateFC-P
_DLLP_TYPE_UPDATE_FC_NP	UpdateFC-NP
_DLLP_TYPE_UPDATE_FC_CPL	UpdateFC-Cpl
_DLLP_TYPE_PM	All Power Management DLLP types
_DLLP_TYPE_INVALID	Invalid DLLP types
_DLLP_TYPE_INIT_FC	All InitFC DLLP types
_DLLP_TYPE_UPDATE_FC	All UpdateFC DLLP types
_ANY_TYPE	All possible DLLP types

Example:

```
SendDllpType(_DLLP_TYPE_ACK );     # - send Ack DLLPs to the script
…

SendDllpType(_DLLP_TYPE_UPDATE_FC); # send all UpdateFC DLLPs
```

8.13 FilterDllpType()

This function specifies more precise tuning (filtering out) for sending DLLP packets to the script.

Format : **FilterDllpType(*dllp_type*)**

Parameters:

dllp_type – encoding of the DLLP type. This parameter may be one of the values defined for the SendDllpType() function.

Example:

```
SendDllpType(_DLLP_TYPE_INIT_FC); # send all InitFC DLLPs to the script
FilterDllpType(_DLLP_TYPE_INIT_FC1_CPL); # don't send InitFCs for Completions
FilterDllpType(_DLLP_TYPE_INIT_FC2_CPL);

# only InitFC DLLPs for Posted and Non-posted requests will be sent to the
script
```

8.14 SendTlpType()

This function specifies more precise tuning (filtering in) for sending TLP packets to the script.

Format : **SendDllpType(*tlp_type*)**

Parameters:

tlp_type – encoding of the TLP type. This parameter may be one of the following values:

TLP type values:

Constant	TLP type
_TLP_TYPE_INVALID	Invalid TLP types
_TLP_TYPE_MRD32	Memory Read Request, 32-bit address format
_TLP_TYPE_MRDLK32	Memory Read Request - Locked, 32-bit address format
_TLP_TYPE_MWR32	Memory Write Request, 32-bit address format
_TLP_TYPE_MRD64	Memory Read Request, 64-bit address format
_TLP_TYPE_MRDLK64	Memory Read Request – Locked, 64-bit address format
_TLP_TYPE_MWR64	Memory Write Request, 64-bit address format
_TLP_TYPE_IORD	I/O Read Request
_TLP_TYPE_IOWR	I/O Write Request
_TLP_TYPE_CFGRD_0	Configuration Read Type 0
_TLP_TYPE_CFGWR_0	Configuration Write Type 0
_TLP_TYPE_CFGRD_1	Configuration Read Type 1
_TLP_TYPE_CFGWR_1	Configuration Write Type 1
_TLP_TYPE_MSG	Message Request
_TLP_TYPE_MSGD	Message Request with Data payload
_TLP_TYPE_MSGAS	Message for Advanced Switching
_TLP_TYPE_MSGASD	Message for Advanced Switching with Data
_TLP_TYPE_CPL	Completion
_TLP_TYPE_CPLD	Completion with Data
_TLP_TYPE_CPLLK	Completion for Locked Memory Read
_TLP_TYPE_CPLDLK	Completion for Locked Memory Read with Data

_TLP_TYPE_MEMORY	All Memory Request TLP types
_TLP_TYPE_IO	All I/O Request TLP types
_TLP_TYPE_CONFIG	All Configuration Request TLP types
_TLP_TYPE_MESSAGE	All Message Request TLP types
_TLP_TYPE_COMPLETION	All Completion TLP types
_ANY_TYPE	All possible TLP types

Example:

```
SendTlpType( _TLP_TYPE_ID_MSG ); # - send Message Request TLPs to the script
…

SendTlpType( _TLP_TYPE_MEMORY ); # send all Memory Request TLPs to the script
```

8.15 FilterTlpType()

This function specifies more precise tuning (filtering out) for sending TLP packets to the script.

Format : **FilterTlpType(*tlp_type*)**

Parameters:

tlp_type – encoding of the TLP type. This parameter may be one of the values defined for the SendTlpType() function.

Example:

```
SendTlpType(_TLP_TYPE_CONFIG); # send all Configuration Request TLPs to the
script
FilterTlpType(_TLP_TYPE_ID_CFGRD_1); # don't send Type 1 requests
FilterTlpType(_TLP_TYPE_ID_CFGWR_1);

# only Type 0 Configuration Request TLPs will be sent to the script
```

8.16 SendOrderedSetType()

This function specifies more precise tuning (filtering in) for sending Ordered Set packets to the script.

Format : **SendOrderedSetType(*set_type*)**

Parameters:

set_type – encoding of the Ordered Set type. This parameter may be one of the following values:

Ordered Set type values:

Constant	**DLLP type**

_ORDSET_TYPE_TS1	Training Sequence Type 1
_ORDSET_TYPE_TS2	Training Sequence Type 2
_ORDSET_TYPE_FTS	Fast Training Sequence
_ORDSET_TYPE_IDLE_SET	Idle Set
_ORDSET_TYPE_IDLE_GLC	Idle Glc Set
_ORDSET_TYPE_SKIP	Skip
_ORDSET_TYPE_PATN	Pattern
_ANY_TYPE	All possible Ordered Set types

Example:

```
SendOrderedSetType(_ORDSET_TYPE_FTS);    # - send Fast Training Sequences to
the script
…
```

8.17 FilterOrderedSetType()

This function specifies more precise tuning (filtering out) for sending Ordered Set packets to the script.

Format : **FilterOrderedSetType(*set_type*)**

Parameters:

set_type – encoding of the Ordered Set type. This parameter may be one of the values defined for the SendOrderedSetType() function.

Example:

```
FilterOrderedSetType(_ORDSET_TYPE_SKIP); # don't send Skip packets
```

9 Timer functions

This group of functions covers VSE capability to work with timers –-- internal routines that repeatedly measures a timing intervals between different events.

9.1 VSE time object

A VSE time object is a special object that presents time intervals in verification scripts. From point of view of the *CSL*, the verification script time object is a "list"-object of two elements. (Please see the *CSL Manual* for more details about CSL types)

[seconds, nanoseconds]

NOTE: The best way to construct VSE time object is to use Time() function (see below).

9.2 SetTimer()

Starts timing calculation from the event where this function was called.

Format : **SendTimer(*timer_id* = 0)**

Parameters:

timer_id – a unique timer identifier.

Example:

```
SetTimer();          # - start timing for timer with id = 0;
SetTimer(23);        # - start timing for timer with id = 23;
```

Remark :

If this function is called a second time for the same timer id, it resets the timer and starts timing calculations again from the point where it was called.

9.3 KillTimer()

Stops timing calculation for a specific timer and frees related resources.

Format : **KillTimer(*timer_id* = 0)**

Parameters:

timer_id – a unique timer identifier.

Example:

```
KillTimer();          # - stop timing for timer with id = 0;
KillTimer(23);        # - stop timing for timer with id = 23;
```

9.4 GetTimerTime()

Retrieve the timing interval from the specific timer

Format : **GetTimerTime (*timer_id* = 0)**

Parameters:

timer_id – a unique timer identifier.

Return values:

Returns VSE time object from timer with id = timer_id.

Example:

```
GetTimerTime ();          # - Retrieve timing interval for timer with id = 0;
GetTimerTime (23);        # - Retrieve timing interval for timer with id = 23;
```

Remark :

This function, when called, does not reset the timer.

10 Time construction functions

This group of functions are used to construct VSE time objects.

10.1 Time()

Constructs a verification script time object.

Format : **Time(*nanoseconds*)**
Time(*seconds, nanoseconds*)

Return values:

First function returns *[0, nanoseconds]*, second one returns *[seconds, nanoseconds]*

Parameters:

nanoseconds – number of nanoseconds in specified time
seconds – number of seconds in specified time

Example:

```
Time ( 50 * 1000 );      # - create time object of 50 microseconds
Time (3, 100);          # - create time object of 3 seconds and 100
nanoseconds
Time( 3 * MICRO_SECS );  # - create time object of 3 microseconds
Time( 4 * MILLI_SECS    ); # - create time object of 4 milliseconds
```

NOTE: MICRO_SECS and MILLI_SECS are constants defined in *VS_constants.inc*.

11 Time calculation functions

This group of functions covers VSE capability to work with "time" – VSE time objects.

11.1 AddTime()

Adds two VSE time objects

Format : **AddTime(*time1*, *time2*)**

Return values:

Returns VSE time object representing the time interval equal to the sum of *time_1* and *time_2*

Parameters:

time_1 - VSE time object representing the first time interval
time_2 - VSE time object representing the second time interval

Example:

```
t1 = Time(100);
t2 = Time(2, 200);
t3 = AddTime( t1, t2 )  # - returns VSE time object = 2 sec 300 ns.
```

11.2 SubtractTime()

Subtract two VSE time objects

Format : **SubtractTime (*time1*, *time2*)**

Return values:

Returns VSE time object representing the time interval equal to the difference between *time_1* and *time_2*

Parameters:

time_1 - VSE time object representing the first time interval
time_2 - VSE time object representing the second time interval

Example:

```
t1 = Time(100);
t2 = Time(2, 200);
t3 = SubtractTime ( t2, t1 )  # - returns VSE time object = 2 sec 100 ns.
```

11.3 MulTimeByInt()

Multiplies VSE time object by integer value

Format : **MulTimeByInt (*time, mult*)**

Return values:

Returns VSE time object representing the time interval equal to the product of *time* * *mult*

Parameters:

time - VSE time object
mult - multiplier, integer value

Example:

```
t   = Time(2, 200);
t1 = MulTimeByInt ( t, 2 )  # - returns VSE time object = 4 sec 400 ns.
```

11.4 DivTimeByInt()

Divides VSE time object by integer value

Format : **DivTimeByInt (*time, div*)**

Return values:

Returns VSE time object representing the time interval equal to the quotient of *time* / *div*

Parameters:

time - VSE time object
div - divisor, integer value

Example:

```
t   = Time(2, 200);
t1 = DivTimeByInt ( t, 2 )  # - returns VSE time object = 1 sec 100 ns.
```

12 Time logical functions

This group of functions covers VSE capability to compare VSE time objects

12.1 IsEqualTime()

Verifies that one VSE time object is equal to the other VSE time object

Format : **IsEqualTime (*time1, time2*)**

Return values:

Returns 1 if time_1 is equal to time_2, returns 0 otherwise

Parameters:

time_1 - VSE time object representing the first time interval
time_2 - VSE time object representing the second time interval

Example:

```
t1 = Time(100);  t2 = Time(500);
If(  IsEqualTime( t1, t2 ) ) DoSomething();
```

12.2 IsLessTime()

Verifies that one VSE time object is less than the other VSE time object

Format : **IsLessTime (*time1, time2*)**

Return values:

Returns 1 if time_1 is less than time_2, returns 0 otherwise

Parameters:

time_1 - VSE time object representing the first time interval
time_2 - VSE time object representing the second time interval

Example:

```
t1 = Time(100);  t2 = Time(500);
If(  IsLessTime ( t1, t2 ) ) DoSomething();
```

12.3 IsGreaterTime()

Verifies that one VSE time object is greater than the other VSE time object

Format : **IsGreaterTime (*time1, time2*)**

Return values:

Returns 1 if time_1 is greater than time_2, returns 0 otherwise

Parameters:

time_1 - VSE time object representing the first time interval
time_2 - VSE time object representing the second time interval

Example:

```
t1 = Time(100);  t2 = Time(500);
If(  IsGreaterTime ( t1, t2 ) ) DoSomething();
```

12.4 IsTimeInInterval()

Verifies that a VSE time object is greater than some VSE time object and less than the other VSE time object

Format : **IsTimeInInterval(min_time, time, max_time)**

Return values:

Returns 1 if min_time <= time <= max_time, returns 0 otherwise

Parameters:

time_1 - VSE time object representing the first time interval
time_2 - VSE time object representing the second time interval

Example:

```
t1 = Time(100);
t   = Time(400);
t2 = Time(500);
If(  IsTimeInInterval ( t1, t, t2 ) ) DoSomething();
```

13 Time text functions

This group of functions covers VSE capability to convert VSE time objects into text strings.

13.1 TimeToText()

Converts a VSE time object into text.

Format : **TimeToText (*time*)**

Return values:

Returns a text representation of VSE time object

Parameters:

time - VSE time object

Example:

```
t = Time(100);
ReportText( TimeToText( t ) ); # see below details for ReportText() function
```

14 Output functions

This group of functions covers VSE capability to present information in the output window.

14.1 ReportText()

Outputs text in the output window related to the verification script

Format : **ReportText (*text*)**

Parameters:

text - text variable,constant or literal

Example:

```
…
ReportText ( “Some text” );
…
t = “Some text”
ReportText ( t );
…
num_of_frames = in.NumOfFrames;
text = Format( “Number of frames : %d”,  num_of_frames );
ReportText ( text );
…
x = 0xAAAA;
y = 0xBBBB;
text = FormatEx( “x = 0x%04X,  y = 0x%04X”, x, y );
ReportText( “Text : ” + text );
...
```

14.2 EnableOutput()

Enables showing information in the output window and sending COM reporting notifications to COM clients.

Format : **EnableOutput ()**

Example:

```
EnableOutput ( );
```

14.3 DisableOutput()

Disables showing information in the output window and sending COM reporting notifications to COM clients.

Format : **DisableOutput ()**

Example:

```
DisableOutput ();
```

15 Information functions

15.1 GetTraceName()

This function returns the filename of the trace file being processed by VSE.

If the script is being run over a multi-segmented trace, this function will return the path to the segment being processed.

Format : **GetTraceName(filepath_compatible)**

Parameters:

filepath_compatible - if this parameter is present and not equal to 0, the returned value may be used as part of the filename.

Example:

```
ReportText( "Trace name : " + GetTraceName() );
…
File = OpenFile( "C:\\My Files\\" +  GetTraceName(1) + "_log.log" );

#  For trace file with path -  D:\Some FC Traces\Data.fct
#  GetTraceName(1) will return - "D_Some FC Traces_Data.fct"
```

15.2 GetScriptName()

This function returns the name of the verification script where this function is called.

Format : **GetScriptName()**

Example:

```
ReportText( "Current script : " + GetScriptName() );
```

15.3 GetApplicationFolder()

This function returns the full path of the folder where the FCTracer application was started.

Format : **GetApplicationFolder()**

Example:

```
ReportText( "FCTracer folder : " + GetApplicationFolder () );
```

15.4 GetCurrentTime()

This function returns the string representation of the current system time.

Format : **GetCurrentTime()**

Example:

```
ReportText( GetCurrentTime() ); # will yield "February 10, 2004, 5:49 PM"
```

15.5 GetEventSegNumber()

In case if a multi-segmented trace is being processed, this function returns the index of the segment for the current event.

NOTE: When a multi-segmented trace file (extension *.*pem*) is processed by VSE – different trace events in different segments of the same trace file may have the same indexes (value stored in *in.Index* input context members) – but they will have different segment numbers.

Format : **GetEventSegNumber()**

Example:

```
ReportText( Format( "Current segment =  %d", GetEventSegNumber() ) );
```

15.6 GetTriggerPacketNumber()

This function returns the number of the trigger packet in the trace. In case no trigger event was recorded in the trace, a value of 0xFFFFFFFF is returned.

Format : **GetTriggerPacketNumber()**

Example:

```
ReportText( FormatEx( "Trigger packet # : %i",  GetTriggerPacketNumber() );
```

16 Navigation functions

16.1 GotoEvent ()

This function forces the application to jump to some trace event and show it in the main trace view.

Format : **GotoEvent(level, index, segment)**
GotoEvent()

Parameters:

level - the transaction level of the event to jump to (possible values: *_PACKET*, *_LINK*, *_SPLIT*)

index - the transaction index of the event to jump to

segment - the segment index of the event to jump to. If omitted, the current segment index will be used.

Remarks:

If no parameters were specified, the application will jump to the current event being processed by VSE. The *segment* parameter is used only when the verification script is running over a multi-segmented trace (extension: **.pem*). For regular traces it is ignored.

If wrong parameters were specified (like an index exceeding the maximum index for the specified transaction level), the function will do nothing and an error message will be sent to the output window.

Example:

```
  …
 if( Something == interesting  )  GotoEvent(); # go to the current event
 …
 if( SomeCondition )
 {
     interesting_segment = GetEventSegNumber();
     interesting_level       =  in.Level;
     interesting_index      =  in.Index;
 }
 …
 OnFinishScript()
{
      …
       # go to the interesting event…
       GotoEvent( interesting_level, interesting_index, interesting_segment );
}
```

16.2 SetMarker()

This function sets a marker for some trace event.

Format : **SetMarker(marker_text)**
SetMarker(marker_text, level, index, segment)

Parameters:

marker_text - the text of the marker

level - the transaction level of the event to jump to (possible values: *_PACKET*, *_LINK*, *_SPLIT*)

index - the transaction index of the event to jump to

segment - the segment index of the event to jump to. If omitted, the current segment index will be used.

Remarks:

If no parameters were specified, other than *marker_text*, the application will set a marker to the current event being processed by VSE. The *segment* parameter is used only when a verification script is running over a multi-segmented trace (extension: **.pem*). For regular traces it is ignored.

If wrong parameters were specified (like an index exceeding the maximum index for a specified transaction level), the function will do nothing and an error message will be sent to the output window.

Example:

```
…
# set marker to the current event
if( Something == interesting  )  SetMarker( "!!! Something cool !!!" );
…
if( SomeCondition )
{
    interesting_segment = GetEventSegNumber();
    interesting_level       =  in.Level;
    interesting_index      =  in.Index;
}
…
OnFinishScript()
{
     …
      # set marker to the interesting event…
      SetMarker(  "  !!! Cool Marker !!! ", interesting_level,
interesting_index,
                  interesting_segment );

      # go to the interesting event…
      GotoEvent( interesting_level, interesting_index, interesting_segment );
}
```

17 File functions

This group of functions covers VSE capabilities to work with the external files.

17.1 OpenFile()

This function opens a file for writing.

Format : **OpenFile(*file_path, append*)**

Parameters:

file_path - the full path to the file to open. (For '\' use '\\')

append - this parameter (if present and not equal to 0) specifies that VSE should append to the contents of the file – otherwise, the contents of the file will be overwritten.

Return Values:

The "handle" to the file to be used in other file functions.

Example:

```
…
set file_handle = 0;
…
file_handle  = OpenFile( "D:\\Log.txt" );  # opens file, the previous
contents will be
                                           # erased.
…
WriteString(  file_handle, "Some Text1" );   # write text string to file
WriteString(  file_handle, "Some Text2" );   # write text string to file
…
CloseFile( file_handle ); # closes file
…
# opens file, the following file operations will append to the contents of
the file.
file_handle  = OpenFile( GetApplicationFolder() + "Log.txt", _APPEND );
```

17.2 CloseFile()

This function closes an opened file.

Format : **CloseFile(*file_handle*)**

Parameters:

file_handle - the file "handle".

Example:

```
…
set file_handle = 0;
…
file_handle  = OpenFile( "D:\\Log.txt" );  # opens file, the previous contents will
be
                                                # erased.
…
WriteString(  file_handle, "Some Text1" );   # write text string to file
WriteString(  file_handle, "Some Text2" );   # write text string to file
…
CloseFile( file_handle ); # closes file
…
```

17.3 WriteString()

This function writes a text string to the file.

Format : **WriteString(*file_handle, text_string*)**

Parameters:

file_handle - the file "handle".
text_string - the text string".

Example:

```
…
set file_handle = 0;
…
file_handle  = OpenFile( "D:\\Log.txt" );  # opens file, the previous
contents will be
                                                # erased.
…
WriteString(  file_handle, "Some Text1" );   # write text string to file
WriteString(  file_handle, "Some Text2" );   # write text string to file
…
CloseFile( file_handle ); # closes file
...
```

17.4 ShowInBrowser()

This function allows you to open a file in the Windows Explorer. If the extension of the file has the application registered to open files with such extensions – it will be launched. For instance, if

Internet Explorer is registered to open files with extensions **.htm* and the file handle passed to *ShowInBrowser()* function belongs to a file with such an extension,this file will be opened in the Internet Explorer.

Format : **ShowInBrowser (*file_handle*)**

Parameters:

file_handle - the file "handle".

Example:

```
…
set html_file = 0;
…
html_file = OpenFile( "D:\\Log.htm" );
…
WriteString(  html_file, "<html><head><title>LOG</title></head>" );
WriteString(  html_file, "<body>" );
…
WriteString(  html_file, "</body></html>" );
ShowInBrowser( html_file );  # opens the file in Internet Explorer
CloseFile( html_file );
...
```

18 COM/Automation communication functions

This group of functions covers VSE capabilities to communicate with COM/Automation clients connected to the FCTracer application. (Please refer to the *FCTracer Automation* manual for the details on how to connect to the FCTracer application and VSE)

18.1 NotifyClient()

This function allows you to send information to COM/Automation client applications in a custom format. The client application will receive a VARIANT object which it is supposed to parse.

Format : **NotifyClient(*param_list*)**

Parameters:

param_list - the list of parameters to be sent to the client application. Each parameter might be an integer, string or list.
(See *CSL Manual* for details about data types available in CSL).

Because the list itself may contain integers, strings, or other lists – it is possible to send complicated messages.
(lists should be treated as arrays of VARIANTs)

Example:

```
…
if( SomeCondition() )
{
      NotifyClient( 2, [ in.Index, in.Level, "CHANNEL 2", "TLP",
                                    TimeToText( in.Time )] );
}
…
# Here we sent 2 parameters to  clients applications :
#   2 ( integer ),
#  [ in.Index, in.Level, "CHANNEL 2", "TLP", TimeToText( in.Time )] ( list )
```

Remark:

See an example of handling this notification by client applications and parsing code in the *PE Automation* document.

19 User input functions

19.1 MsgBox()

Displays a message in a dialog box, waits for the user to click a button, and returns an Integer indicating which button the user clicked.

Format : **MsgBox(prompt, type, title)**

Parameters:

prompt - Required. String expression displayed as the message in the dialog box.

type - Optional. Numeric expression that is the sum of values specifying the number and type of buttons to display, the icon style to use, the identity of the default button, and the modality of the message box. If omitted, the default value for buttons is *_MB_OK*. (See the list of possible values in the table below)

title - Optional. String expression displayed in the title bar of the dialog box. If you omit the title, the script name is placed in the title bar.

The *type* argument values are:

Constant	Description
_MB_OKONLY	Display **OK** button only (by Default).
_MB_OKCANCEL	Display **OK** and **Cancel** buttons.
_MB_RETRYCANCEL	Display **Retry** and **Cancel** buttons.
_MB_YESNO	Display **Yes** and **No** buttons.
_MB_YESNOCANCEL	Display **Yes**, **No**, and **Cancel** buttons.
_MB_ABORTRETRYIGNORE	Display **Abort**, **Retry**, and **Ignore** buttons.
_MB_EXCLAMATION	Display **Warning Message** icon.
_MB_INFORMATION	Display **Information Message** icon.
_MB_QUESTION	Display **Warning Query** icon.
_MB_STOP	Display **Critical Message** icon.
_MB_DEFBUTTON1	First button is default.
_MB_DEFBUTTON2	Second button is default.
_MB_DEFBUTTON3	Third button is default.
_MB_DEFBUTTON4	Fourth button is default.

Return Values:

This function returns an integer value indicating which button the user clicked.

Constant	Description
_MB_OK	**OK** button was clicked.
_MB_CANCEL	**Cancel** button was clicked.
_MB_YES	**Yes** button was clicked.
_MB_NO	**No** button was clicked.
_MB_RETRY	**Retry** button was clicked.
_MB_IGNORE	**Ignore** button was clicked.
_MB_ABORT	**Abort** button was clicked.

Remark:

This function works only for VS Engines controlled via the GUI. For VSEs controlled by COM/Automation clients, it does nothing.

This function "locks" the FCTracer application, which means that there is no access to other application features until the dialog box is closed. In order to prevent too many *MsgBox* calls -- in the case of a script not written correctly – VSE keeps track of all function calls demanding user interaction and doesn't show dialog boxes if a customizable limit was exceeded (returns *_MB_OK* in this case).

Example:

```
    ...
if( Something )
  {
        …
     str = "Something happened!!!\nShould we continue?"
        result = MsgBox( str ,
         _ MB_YESNOCANCEL | _MB_EXCLAMATION,
                  "Some Title" );

        if( result != _MB_YES )
        ScriptDone();
     … # Go on…
  }
```

19.2 InputBox()

Displays a prompt in a dialog box, waits for the user to input text or click a button, and returns a CSL list object (see the *CSL* manual for details about list objects) or a string containing the contents of the text box.

Format : **InputBox(prompt, title, default_text, return_type)**

Parameters:

prompt - Required. String expression displayed as the message in the dialog box.

title - Optional. String expression displayed in the title bar of the dialog box. If you omit *title*, the script name is placed in the title bar.

default_text - Optional. String expression displayed in the text box as the default response if no other input is provided. If you omit *default_text*, the text box is displayed empty.

return_type – Optional. It specifies the contents of the return object.

The *return_type* argument values are:

Constant	Value	Description
_IB_LIST	0	CSL list object will be returned (by Default).
_IB_STRING	1	String input as it was typed in the text box

Return Values:

Depending upon the *return_type* argument, this function returns either a CSL list object or the text typed in the text box as it is.

In case of *return_type* = *_IB_LIST* (by default), the text in the text box is considered as a set of list items delimited by ',' (only hexadecimal, decimal, and string items are currently supported).
Text example:

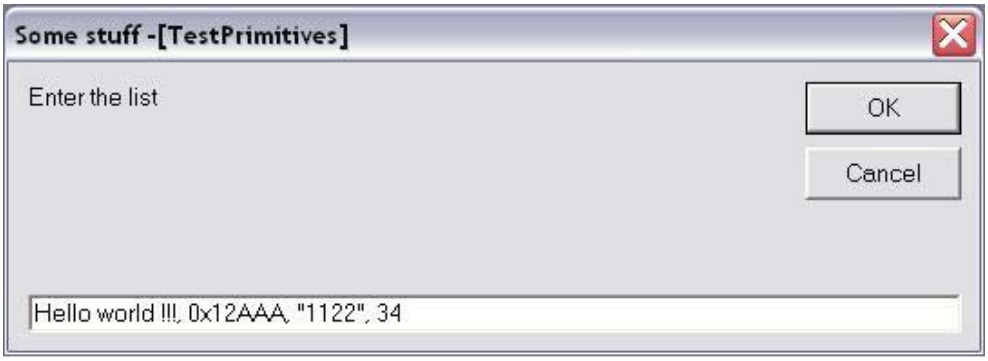
```
Hello world !!!, 12, Something, 0xAA, 10, "1221"
```

Will produce a CSL list object of5 items:

```
list =      [ "Hello world !!!", 12, "Something", 0xAA, 10, "1221" ];

list [0] =  "Hello world !!!"
list [1] = 12
list [2] = "Something"
list [3] = 0xAA
list [4] = 10
list [5] = "1212"
```

NOTE: Although the dialog box input text parser tries to determine a type of list item automatically, a text enclosed in quote signs "" is always considered as a string.



Remark:

This function works only for VS Engines controlled via the GUI. For VSEs controlled by COM/Automation clients, it does nothing.

This function "locks" the FCTracer application, which means that there is no access to other application features until the dialog box is closed. In order to prevent too many *InputBox* calls -- in the case of a script not written correctly – VSE keeps track of all function calls demanding user interaction and doesn't show dialog boxes if a customizable limit was exceeded (returns *null* object in that case).

Example:

```
      ...
   if( Something )
    {
            …
        v = InputBox( "Enter the list", "Some stuff", "Hello world !!!, 0x12AAA,
Some, 34" );
            ReportText ( FormatEx( "input = %s, 0x%X, %s, %d", v[0],v[1],v[2],v[3]
) );
       … # Go on…

       str =  InputBox( "Enter the string", "Some stuff", "<your string>",
_IB_STRING  );
       ReportText( str );
    }
```

19.3 GetUserDlgLimit()

This function returns the current limit of user dialogs allowed in the verification script. If the script reaches this limit, no user dialogs will be shown and the script will not stop. By default this limit is set to 20.

Format : **GetUserDlgLimit()**

Example:

```
…
    result = MsgBox( Format( "UserDlgLimit = %d", GetUserDlgLimit() ),
     _MB_OKCANCEL | _MB_EXCLAMATION, "Some Title !!!" );

  SetUserDlgLimit( 2 ); #  set the limit to 2
…
```

19.4 SetUserDlgLimit()

This function sets the current limit of user dialogs allowed in the verification script. If the script reaches this limit, no user dialogs will be shown and script will not stop. By default this limit is set to 20.

Format : **SetUserDlgLimit()**

Example:

```
…
    result = MsgBox( Format( "UserDlgLimit = %d", GetUserDlgLimit() ),
     _MB_OKCANCEL | _MB_EXCLAMATION, "Some Title !!!" );

  SetUserDlgLimit( 2 ); #  set the limit to 2
…
```

20 String manipulation/formating functions

20.1 FormatEx()

Write formatted data to a string. *FormatEx()* is used to control the way that arguments will print out. The format string may contain conversion specifications that affect the way in which the arguments in the value string are returned. Format conversion characters, flag characters, and field width modifiers are used to define the conversion specifications.

Format : **FormatEx (format_string, argument_list)**

Parameters:

format_string - Format-control string

argument_list- Optional list of arguments to fill in the format string

Return Values:

Formatted string .

Format conversion characters:

Code	Type	Output
c	Integer	Character
d	Integer	Signed decimal integer
i	Integer	Signed decimal integer
o	Integer	Unsigned octal integer
u	Integer	Unsigned decimal integer
x	Integer	Unsigned hexadecimal integer, using "abcdef."
X	Integer	Unsigned hexadecimal integer, using "ABCDEF."
s	String	String

Remark:

A conversion specification begins with a percent sign (%) and ends with a conversion character. The following optional items can be included, in order, between the % and the conversion character to further control argument formatting:

- Flag characters are used to further specify the formatting. There are five flag characters: A minus sign (-) will cause an argument to be left-aligned in its field. Without the minus sign, the default position of the argument is right-aligned.
- A plus sign (+) will insert a plus sign before a positive signed integer. This only works with the conversion characters *d* and *i*.

- A space will insert a space before a positive signed integer. This only works with the conversion characters *d* and *i*. If both a space and a plus sign are used, the space flag will be ignored.

- A hash mark (#) will prepend a 0 to an octal number when used with the conversion character *o*. If # is used with *x* or *X*, it will prepend *0x* or 0*X* to a hexadecimal number.

- A zero (*0*) will pad the field with zeros instead of with spaces.

- Field width specification is a positive integer that defines the field width, in spaces, of the converted argument. If the number of characters in the argument is smaller than the field width, then the field is padded with spaces. If the argument has more characters than the field width has spaces, then the field will expand to accommodate the argument.

Example:

```
str = "String";
i = 12;
hex_i = 0xAABBCCDD;
…
formatted_str = FormatEx( "%s, %d, 0x%08X", str, i, hex_i );

#  formatted_str = "String, 12, 0xAABBCCDD"
```

21 Miscellaneous functions

21.1 ScriptForDisplayOnly()

Specifies that the script is designed for displaying information only and that its author doesn't care about verification script result. Such a script will have a result of *DONE* after execution.

Format : **ScriptForDisplayOnly ()**

Example:

```
ScriptForDisplayOnly();
```

21.2 Sleep()

Asks VSE not to send any events to a script until the timestamp of the next event is greater than the timestamp of the current event plus sleeping time.

Format : **Sleep(*time*)**

Parameters:

time - VSE time object specifying sleep time

Example:

```
Sleep ( Time(1000) );   # Don't send any event occurred during 1 ms from the
current event
```

21.3 ConvertToHTML()

This function replaces spaces with " " and carriage return symbols with "
" in a text string.

Format : **ConvertToHTML(*text_string*)**

Parameters:

text_string - text string

Example:

```
str   =  "Hello world !!!\n";
str += "How are you today?";

html_str = ConvertToHTML ( str );
    # html_string =
"Hello&nbspworld !!!<br>How&nbspare&nbspyou&nbsptoday?"
```

NOTE : Some other useful miscellaneous functions can be found in the file *VSTools.inc*

21.4 Pause()

Pauses a running script. Later, script execution can be resumed or cancelled.

Format : **Pause()**

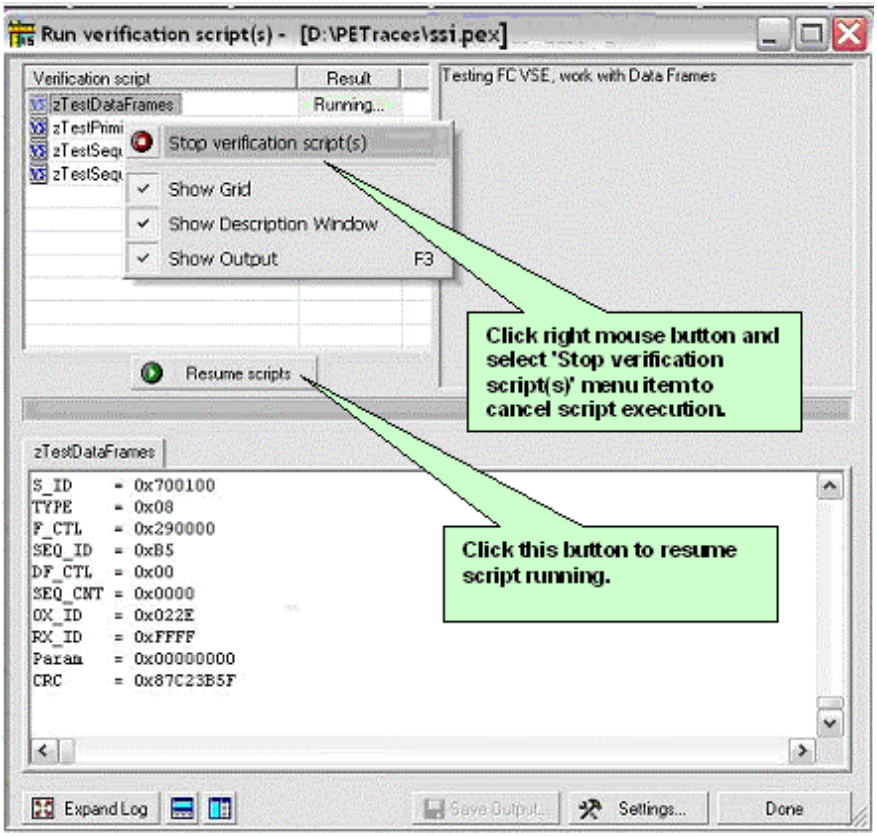
Example:

```
…
If( Something_Interesting() )
{
      GotoEvent();  # Jump to the trace view
      Pause();           # Pause script execution
}
…
```

Remark:

This function works only for VS Engine controlled via a GUI. For VSEs controlled by COM/Automation clients, it does nothing.

When script execution is paused, the Run Verification Script window will look like:



22 The VSE important script files

The VSE working files are located in the ..*Scripts**VFScripts* subfolder of the main PETracer folder. The current version of VSE includes the following files:

File	Description
VSTools.inc	main VSE file containing definitions of some generic and PCI Express-specific VSE script functions provided by LeCroy (must be included in every script)
VS_constants.inc	file containing definitions of some important generic and PCI Express-specific VSE global constants
VSTemplate.pev_	template file for new verification scripts.
VSUser_globals.inc	file of user global variable and constant definitions (In this file, it is useful to enter definitions of constants, variables, and functions to be used in many scripts you write.)

22.1 Example script files

The VSE example files are located in the ..*Scripts**VFScripts**Samples* subfolder of the main PETracer folder. The current version of VSE includes the following files:

File	Description
examp_tlp_data.inc	Sample include file containing definitions and functions used by some other sample scripts
examp_dllps.pevs	Sample processing script that outputs information about DLLP packets present in the trace
examp_tlps.pevs	Sample processing script that outputs information about TLP packets present in the trace
examp_ordered_sets.pevs	Sample processing script that outputs information about Ordered Set and Link Condition packets present in the trace
examp_check_errors.pevs	Sample PASS/FAIL script that checks all packets in the trace for all the errors VSE exports and fails in case any error is found
examp_link_transactions.pevs	Sample processing script that outputs information about Link Transactions present in the trace
examp_split_transactions.pevs	Sample processing script that outputs information about Split Transactions present in the trace
examp_metrics.pevs	Sample processing script that outputs information about Memory Write Link Transaction metrics and all Split Transaction metrics

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