pico® Technology

PicoVNA™

Vector Network Analyzer

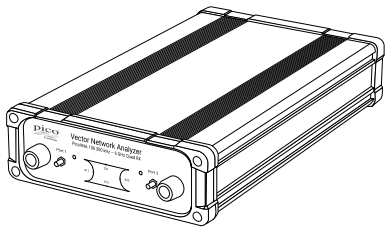
Programmer's Guide

pvpg r1

Contents

1 Welcome

The **PicoVNA Vector Network Analyzer** from Pico Technology is a compact, high-performance measuring instrument.



This manual describes the operation of the PicoVNA 2 library available to support the PicoVNA Vector Network Analyzer (product web page). The key intention of the library is to provide remote automation under standard programming environments such as C, C++, C# or specialist test and measurement, scientific and math environments such as National Instruments LabVIEW and MathWorks MATLAB.

2 Introduction

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2.3 System requirements

To ensure that your PicoVNA Vector Network Analyzer operates correctly, you must have a computer with at least the minimum system requirements to run one of the supported operating systems, as shown in the following table. The performance of the oscilloscope will be better with a more powerful PC, and will benefit from a multicore processor.

Item	Specification
Operating system	Windows 7, 8 or 10 (32-bit and 64-bit versions)
Processor, memory, free disk space	As required by the operating system
Ports	USB 2.0 port
Display size	1280 x 720

2.4 Installing the SDK

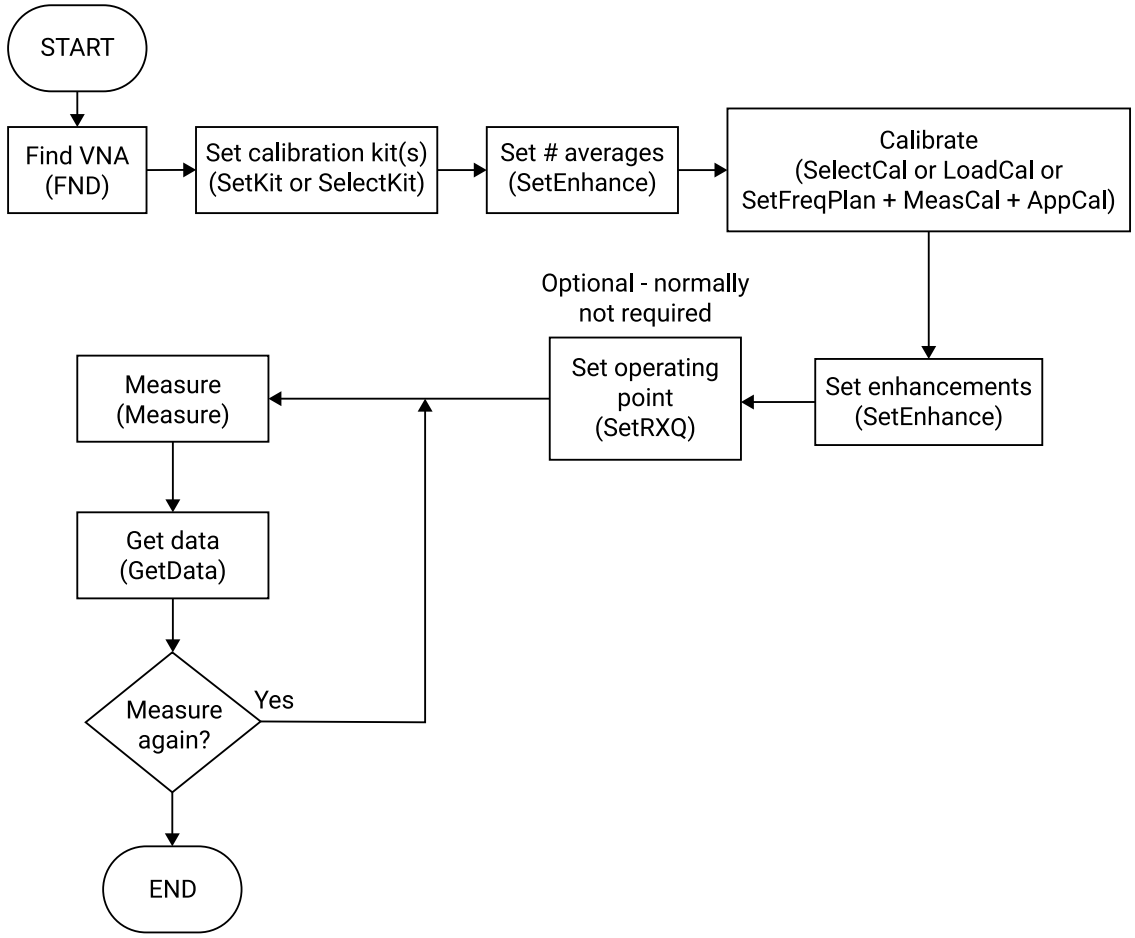
1. Download the latest PicoVNA 2 software installer from www.picotech.com.
2. Run the installer.
3. In case of difficulty, please consult the *PicoVNA Quick Start Guide* for further help.

The control library is a 32-bit Windows COM DLL (`PicoControl2.dll`) that is supplied with the PicoVNA 2 software. Installation of the PicoVNA 2 software automatically installs and registers the `PicoControl2.PicoVNA_2` COM class on the PC.

DLL location
The PicoVNA 2 installer places the location of the DLL on the Windows path, which allows most development tools to find it. If your development tool needs to know the location of this DLL, you may need to modify the tool's search path to point to it.

3 Programming with PicoVNA 2

The diagram below shows the steps to carry out a measurement. It is simplified and incorporates the minimum number of steps to perform a measurement.



4 API functions

4.1 Command summary

Command	Description	Input	Output
AppCal()	Function, apply the calibration	CalType	String: "OK" or "Error"
AppMemMath()	Function, apply vector math to the current measurement	Para, Func	String: "OK" or "Error"
CloseVNA()	Closes the USB connection	None	String: "OK" or "Error"
DLLVer()	Function, query the current DLL version	None	String: <dll version>
DoP1dBCal()	Function, perform a P1dB calibration	Loss1,Loss2,Ftest	String: "OK" or "Error"
DoAMPMCal()	Function, perform an AM to PM calibration	Loss1,Loss2,Ftest	String: "OK" or "Error"
DoP1dBMeas()	Function, measure P1dB	None	String: <P1dB value> or <error message>
DoAMPMMeas()	Function, measure AM to PM	Ptest	String: <AM PM value> or <error message>
FND()	Function, find instrument	None	Integer, serial port
FndPt()	Function, read data (marker function)	Freq, Para, MeasType, Func	String: <freq, pk or min value, bandwidth, freq index> or "Error"
GetData()	Function, read measured data	Para, MeasType, Pnt	String: <freq,value> or "Error"
GetInfo()	Function, read instrument status	Para	String: <value>, "Error"
GetMem()	Function, read memory data	Para, MeasType, Pnt	String:<freq, value> or "Error"
InitVar()	Function, initialize all variables	None	String: "OK"
InsDiag()	Function, perform diagnostic tests	None	None (displays window)
LoadCal()	Function, load a calibration and status from disk	FileName or "?"	String: "OK" or "Error"
MeasCal()	Function, measure a calibration standard	CalType, Standard	String: "OK" or "Error"
Measure()	Function, perform a single sweep measurement	Para	String: "OK" or "Error"
ResetErr()	Routine, resets communication error flag	None	None
SaveCal()	Function, save the current calibration and status to disk	FileName or "?"	String: "OK" or "Error"
SaveKit()	Function, calibration kit [Note: Thru data only saved if kit is on port 1]	FileName, Port	String: "OK" or "Error"
SaveToMem()	Function, save measured data to memory	Para	String: "OK" or "Error"
SelectAMPM()	Routine, measure AM to PM	None	None (displays window)

SelectCal()	Routine, calibrate the instrument	"?" or FileName	String: "OK" or "Error" (displays window)
SelectKit()	Routine, create, load or save a calibration kit	"?" or FileName, Port	String: "OK" or "Error" (displays window)
SelectP1dB()	Routine, measure P1dB	None	None (displays window)
SelectSaveMeas()	Routine, save measured data to disk	None	None (displays window)
SelectSigGen()	Routine, set up the instrument as a synthesized signal generator	None	None (displays window)
SetEnhance()	Function, set measurement enhancement	Para, k	String: "OK" or "Error"
SetFreqPlan()	Function, set the frequency plan	Fstart, Fstep, I, P, BW	String: "OK" or "Error"
SetKit()	Function, create a calibration kit	Name, Ksex, Koff, Koff2, CF0, CF1, CF3, Sind, OffLoss1, OffLoss2, Port, MData, FileName1, Tdata, FileName2	String: "OK" or "Error"
SetLimits()	Function, set pass / fail limits	Segment, Para, FreqLow, FreqHigh, ValMin, ValMax	String: "Error", "OK" or data string
SetSigGen()	Function set up the instrument as a synthesized signal generator	Freq, P	String: "OK" or "Error"
SetRef()	Function, set measurement reference plane	Para, k	String: "OK", "Error" or "No cal"
SetRXQ()	Function, set quiescent point of the receiver	None	String: "OK" or "Error"
SetTrig()	Sets the trigger mode	Mode	String: "OK" or "Error"
TestLimits()	Function, used to do a pass/fail test on the current measured data against set pass/fail limits	Para, FreqLow, FreqHigh, MeasType	String: "Error", "Pass", or string data with failed data
ZConversion()	Function, converts a set of s-parameters from one base impedance to another	ZoOld, ZoNew, S11r, S11i, S21r, S21i, S12r, S12i, S22r, S22i	String: data string or "Error"
SetSysZo()	Function, used to set the system impedance to a value other than 50 Ω	SysZo, ExMatch	String: "OK" or "Error"

4.2 Communications

4.2.1 FND() - discover instrument

```
Public Function FND() As Integer
```

Typical usage
This function is used to find the instrument connected to the PC.

```
variable = FND
```

Action
Searches all available serial ports to find the instrument. If the instrument is found, the function reads factory data from the instrument's EEPROM. This takes about 3 seconds to complete.

Parameter passed	Description	Value
None		

Returns
Serial number of the instrument detected or 0 if no instrument is found.

Return values	Type	Executed correctly	Error
<0 to 9999>	Integer	<1 to 9999>	<0>

Alternatively, you can find a specific instrument by its hardware serial number using FNDSN().

4.2.2 FNDSN() - discover instrument by hardware serial number

```
Public Function FNDSN(
  byVal SN as string
) As Integer
```

Typical usage
This function is used to find a specific instrument connected to the PC:

```
variable = FNDSN(SN)
```

Action
Searches all available USB ports to find the instrument with a matching hardware serial number. If the instrument is found, the function reads factory data from the instrument's EEPROM. This takes about 3 seconds to complete. No parameter is passed in the call.

You can find out the hardware serial number of a device by requesting the "HWSN" parameter from GetInfo(). Note that this has a different value from the serial number returned by FND() and FNDSN().

Parameter passed	Description	Value
SN	Hardware serial number	A string such as "A3VIAUAH".

Returns
Serial number of the instrument detected or 0 if no instrument is found.

Return values	Type	Executed correctly	Error
<0 to 9999>	Integer	<1 to 9999>	<0>

4.2.3 CloseVNA() - close instrument

```
Public Function CloseVNA() As String
```

Typical usage
This function is used to close the instrument connected to the PC.

```
variable = CloseVNA
```

Action
Closes the USB port currently assigned to the instrument.

Parameter passed	Description	Value
None		

Returns
"OK" if currently open USB port is successfully closed. If no USB port currently open the value returned is "Error".

Return values	Type	Executed correctly	Error
"OK", "Error"	String	"OK"	"Error"

4.2.4 ResetErr() - Reset serial communications error flag

```
Public Sub ResetErr()
```

Typical usage
This routine is used to reset the error flag.

Action
Resets the serial communications error flag. No parameters are passed in the call.

Parameter passed	Description	Value
None		

Returns
"OK"

4.3 Calibration

4.3.1 SelectKit() - create kit [dialog]

```
Public Function SelectKit(
  ByVal FileName As String,
  ByVal port As Integer
) as String
```

Typical usage
This routine is used to create or load a calibration kit.

```
variable = SelectKit(FileName, port)
```

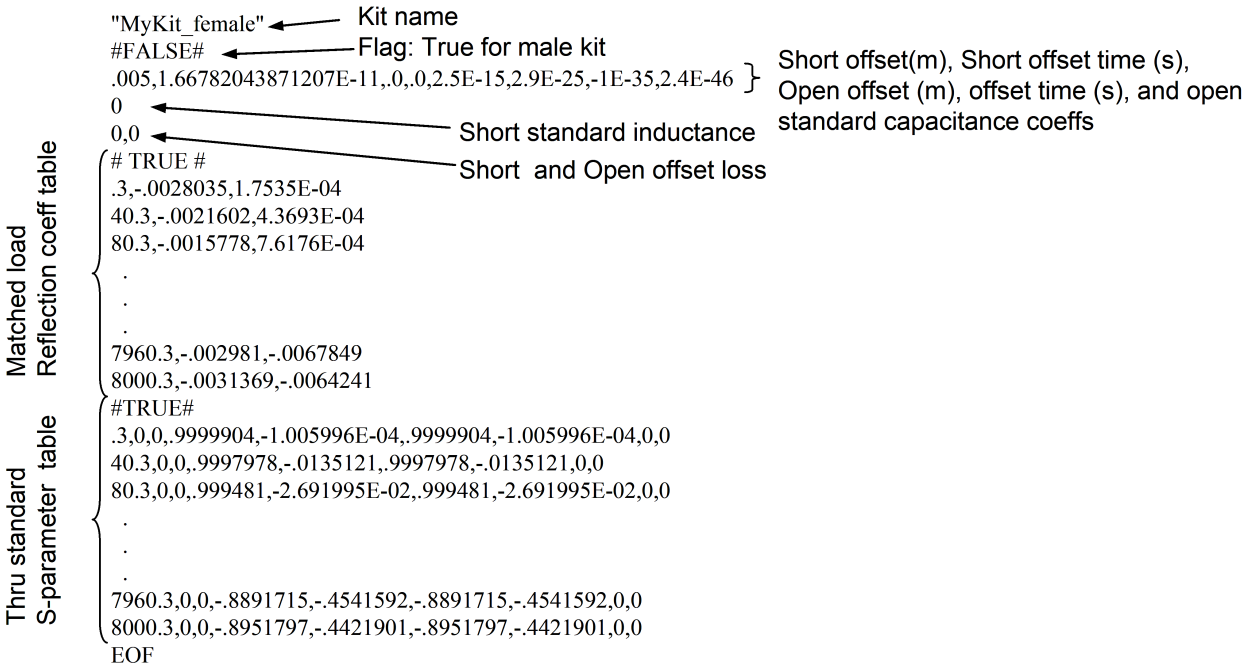
Action
If you pass a "?" instead of a file name, this function displays a dialog that allows the user to select (load from disk) or create and save a calibration kit. On the other hand, if a valid full path file name is passed (of the calibration kit to be loaded) together with either "1" for port 1, or "2" for port 2, then the kit is loaded and applied without a dialog.

Parameter passed	Description	Comments
`FileName`	Full path file name (of calibration kit), test port ("1 " or "2") or "?"	If a "?" is passed, a dialog is displayed

Returns

Return values	Type	Executed correctly	Error
"OK" or "Error"	String	"OK"	"Error"

Example calibration kit file for a female kit with load and through standard data:



In the above, the Short and Open offset refer to the Open and Short reference plane distance. The offset times are the equivalent transit time in free space for this plane distance.

4.3.2 SetKit() - create kit

```
Public Function SetKit(
  ByVal name As String,
  ByVal Ksex As String,
  ByVal Koff As Variant,
  Koff2 As Variant,
  ByVal CF0 As Variant,
  ByVal CF1 As Variant,
  ByVal CF2 As Variant,
  ByVal CF3 As Variant,
  ByVal SIND as Variant,
  ByVal OffLoss1 as Variant,
  ByVal OffLoss2 as Variant,
  ByVal port As Integer,
  ByVal MData As String,
  ByVal FileName1 As String,
  ByVal Tdata as String,
  ByVal FileName2 as String
) As String
```

Typical usage

```
variable =
  SetKit(name,Ksex,Koff,Koff2,CF0,CF1,CF2,CF3,SIND,OffLoss1,OffLoss2,port,MDa
  ta,FileName1,Tdata, FileName2)
```

Action

Creates a calibration kit using the parameters passed. See table below for the type and format of data required. Note that Thru data is only loaded if the kit is to be associated with Port 2 of the instrument.

Parameter passed	Description	Value	Unit
Name	Cal kit name		
Ksex	Cal kit connector sex	"m" or "f"	
Koff	Cal kit's Open standard offset		metre
Koff	Cal kit's Short standard offset		metre
CF0	Open standard capacitance coefficient		farad
CF1	Open standard capacitance coefficient		farad
CF2	Open standard capacitance coefficient		farad
CF3	Open standard capacitance coefficient		farad
SIND	Short standard inductance		henry
OffLoss1	Short offset loss	Typically around 2	GΩ/s
OffLoss2	Open offset loss	Typically around 2	GΩ/s
Port	Port (1 or 2) to which kit applies	1 or 2	
MData	Flag indicates if load data is available	"True" or "False"	
FileName1	Path and file name of Load data file		
TData	Flag indicates if Thru data is available	"True" or "False"	
FileName2	Path and file name of Thru data file		

Returns

Return values	Type	Executed correctly	Error
"OK" or "Error"	String	"OK"	"Error"

Important: Through adaptor data is only loaded and saved when the kit is associated with Port 1 of the instrument. A kit with Thru data may be loaded to Port 2 but the Thru data will be ignored, therefore, if the kit is subsequently resaved the Thru data will be lost.

4.3.3 SetFreqPlan() - set frequency plan

```
Public Function SetFreqPlan(
  ByVal Fstart As Variant,
  ByVal Fstep As Variant,
  ByVal I As Variant,
  ByVal P As Variant,
  ByVal B as Variant
) As String
```

Typical usage
This routine is used to set the frequency plan of the instrument. Typically, the format used is as follows:

```
variable = SetFreqPlan(start_frequency, frequency_step, no_of_points,
  power_level, bandwidth)
```

Action
Sets the frequency sweep.

Parameter passed	Units	Min Value	Max Value	Step size
start_frequency	MHz	0.3	6080	
frequency_step	MHz	0.00001 (10 Hz)	-	
no_of_points (I)		51,101, 201, 401, 801, 1024, 2001, 3001, …. , 9001		
power_level	dBm	–20	+6	0.1
bandwidth	Hz	10	140000	

The sweep is set by passing the start frequency and step size. The step size is calculated by taking the start frequency from the stop frequency and dividing by the (number of points – 1). The stop frequency must not be greater than 6080 MHz

$$Fstop = Fstart + Fstep(Npoints - 1) \leq 6080\ MHz$$

Returns

Return values	Type	Executed correctly	Error
"OK" or "Error"	String	"OK"	"Error"

Note: If a valid calibration exists, setting a new frequency plan (different from that used during calibration) will cause a new set of (interpolated) error terms to be generated so that a new calibration need not be carried out. Note that this process will delete any measurements saved to memory. Note further that in order to obtain the best instrument capability a new calibration should be performed.

4.3.4 SetCWmode() - set CW sweep plan

```
Public Function SetCWmode(
  ByVal F As Variant,
  ByVal pts As Variant,
  ByVal Po As Variant,
  ByVal Td As Variant
) As String
```

Typical usage
This routine is used to set the CW sweep plan (time sweep) of the instrument. Typically, the format used is as follows:

```
variable = SetCWmode(frequency, no_of_points, power_level,
  time_between_points)
```

Action
Sets the CW mode sweep.

Parameter passed	Units	Min Value	Max Value	Resolution
frequency	MHz	0.3	6080	*
no_of_points	-	2	9001	1
power_level	dBm	–20	0	0.1
time_between_points	ms	0.5	65	0.001

*Frequency resolution:

0.3 MHz to 62.5 MHz:	0.1 Hz
62.5 MHz to 3 GHz:	10 Hz or better
3 GHz to 6 GHz:	20 Hz

Returns

Return values	Type	Executed correctly	Error
“OK” or “Error”	String	“OK”	“Error”

4.3.5 SelectCal() - calibrate and set frequency plan

```
Public Function SelectCal(
  ByVal FileName as string
) as String
```

Typical usage
This routine is used to set the frequency plan and calibrate the instrument.

Action
If a "?" string is passed then this function displays a dialog that allows the user to set the frequency plan (start, stop and number of frequency points) and complete calibration of the instrument. If a valid full path file name holding a calibration is passed, then the calibration will be loaded without displaying a dialog.

Parameter passed	Description	Value
FileName	Full path file name (of calibration file) or "?"	If a "?" is passed a dialog is displayed

Returns

Return values	Type	Executed correctly	Error
"OK" or "Error"	String	"OK"	"Error"

Note: If a valid calibration exists, setting a new frequency plan (different from that used during calibration) only will cause a new set of (interpolated) error terms to be generated so that a new calibration need not be carried out. Note that this process will delete any measurements saved to memory. Note further that in order to obtain the best instrument capability a new calibration should be performed whenever the sweep parameters change.

4.3.6 MeasCal() - measure calibration standard

```
Public Function MeasCal(
  ByVal CalType As Variant,
  ByVal Standard As Variant
) As String
```

Typical usage

```
variable = MeasCal(CalType, Standard)
```

Action

Measures a calibration standard (used during the calibration procedure). The parameters passed are described below.

Parameter passed	Description	Value
CalType	Calibration type	"S11", "S21", "S11+S21", "All", "Alln", "Allut"
Standard	Calibration standard	"Open", "Short", "Load", "Thru" or "Isolation" "OpenP1", "OpenP2", "ShortP1", "ShortP2" "ShortP1OpenP2", "OpenP1ShortP2", "LoadP1" "LoadP2", "LoadP1ShortP2", "LoadP2ShortP1"

Note! Calibration types are as follows:

"S11"	1 port correction
"S21"	frequency response (with optional isolation) correction
"S11+S21"	1 port correction, with frequency response and isolation correction and source match correction
"All"	Full 12-term correction for insertable device (2 cal kits needed)
"Alln"	Full 12-term correction for non-insertable device (only 1 cal kit)
"Allut"	Unknown through calibration (8-term correction) for non-insertable device (only 1 cal kit)

S11: Calibration standards for one port measurement are as follows:

"Load"	loads on port 1
"Open"	opens on port 1
"Short"	shorts on port 1

S21: Calibration through measurement normalization measurement are as follows:

"Thru"	connect ports 1 and 2
"Isolation"	terminate ports 1

S11+S21: Calibration standards for 2 port device measurement are as follows:

"Load"	loads on port 1 (also measures isolation term)
"Open"	opens on port 1 (also measures isolation term)
"Short"	shorts on port 1 (also measures isolation term)
"Thru"	connect ports 1 and 2

This calibration method uses the various isolation measurements in order to attempt to model the termination dependent isolation term of the instrument. This approach is similar to that described in the *User's Guide* as the 'enhanced isolation calibration'.

`All`: Calibration standards for the insertable device (2 cal kits needed) are as follows:

`"Load"`	loads on port 1 and 2
`"Open"`	opens on port 1 and 2
`"Short"`	shorts on port 1 and 2
`"Thru"`	connect ports 1 and 2
`"Isolation0"`	terminate ports 1 and 2 [conventional isolation calibration
`"Isolation1"`	short on port 1 and open on port 2 [enhanced isolation calibration]

`Alln`: Calibration standards for the non-insertable device (only 1 cal kit) are as follows:

`"LoadP1ShortP2"`	load on port 1, short on port 2 (also measures isolation term)
`"LoadP2ShortP1"`	load on port 2, short on port 1 (also measures isolation term)
`"Thru"`	connect ports 1 and 2 using calibrated through standard

Reflection standards are:

`"ShortP1OpenP2"`	short circuit on port 1, open circuit on port 2 (also measures isolation term)
`"OpenP1ShortP2"`	open circuit on port 1, short circuit on port 2 (also measures isolation term)

This calibration method uses the various isolation measurements in order to attempt to model the termination dependent isolation term of the instrument. This approach is described in the *User's Guide* as the 'enhanced isolation calibration'.

`Allut`: Calibration standards for the non-insertable device using the unknown through calibration (only 1 cal kit) are as follows:

`"LoadP1ShortP2"`	load on port 1, short on port 2 (also measures isolation term)
`"LoadP2ShortP1"`	load on port 2, short on port 1 (also measures isolation term)
`"Thru"`	Connect ports 1 and 2 using reciprocal through adaptor

Reflection standards are:

`"ShortP1OpenP2"`	short circuit on port 1 and open circuit on port 2 (also measures isolation term)
`"OpenP1ShortP2"`	open circuit on port 1 and short circuit on port 2 (also measures isolation term)

This calibration method uses the various isolation measurements in order to attempt to model the termination dependent isolation term of the instrument. This approach is described in the *User's Guide* as the 'enhanced isolation calibration'.

Returns

Return values	Type	Executed correctly	Not executed
"OK" or "Error"	String	"OK"	"Error"

4.3.7 AppCal() - apply calibration

```
Public Function AppCal(
  ByVal CalType As Variant
) As String
```

Typical usage

```
variable = AppCal(CalType)
```

Action

Applies the calibration (used after all calibration standards, i.e. short, open and load, have been measured). The parameter passed is described in the table below.

Parameter passed	Description	Value
CalType	Calibration type	"S11", "S21", "S11+S21", "All", "Alln"

Returns

Return values	Type	Executed correctly	Not executed
"OK" or "Error"	String	"OK"	"Error"

Note! Only use with the MeasCal() commands. Not after using SelectCal() or LoadCal().

4.3.8 SelectP1dB() - calibration and measurement [dialog]

```
Public Sub SelectP1dB()
```

Typical usage
This function is used to perform P1dB calibration and measurements. Typically implemented as follows:

```
Call SelectP1dB
```

or:

```
SelectP1dB
```

Action
A dialog is displayed that allows the user to carry out P1dB measurements interactively. No parameters are passed.

Parameter passed	Description	Value
None		

Returns
Nothing

4.3.9 SelectAMPM() - AM-PM calibration and measurement [dialog]

```
Public Sub SelectAMPM()
```

Typical usage
Used to perform an AM to PM calibration. Typically implemented as follows:

```
Call SelectAMPM
```

or:

```
SelectAMPM
```

Action
A dialog is displayed that allows the user to carry out AM to PM measurements interactively. No parameters are passed.

Parameter passed	Description	Value
None		

Returns
Nothing

4.3.10 DoP1dBCal() - P1dB Calibration

```
Public Function DoP1dBCal(
  ByVal Loss1 As Variant,
  ByVal Loss2 As Variant,
  ByVal Ftest As Variant
) As String
```

Typical usage
Used to perform a P1dB calibration. Typically implemented as follows:

```
variable = DoP1dBCal(Loss1, Loss2, Ftest)
```

Action
Performs a P1dB calibration. This is used prior to carrying out a P1dB measurement. No dialog form is displayed. The parameters passed are described in the table below.

Note! P1dB Calibration should be carried out without the input or output attenuators in place.

Parameter passed	Description	Value	Unit
`Loss1`	Input attenuation / loss		dB
`Loss2`	Output attenuation / loss		dB
`Ftest *`	Frequency at which the Cal is done	0.3 to 6080	MHz

* setting `Ftest` to 0 will cause calibration using sweep plan stored

Returns

Return values	Type	Executed correctly	Not executed correctly
"`OK`" or "`Error`"	String	"`OK`"	"`Error`"

4.3.11 DoAMPMCal() - AM-PM Calibration

```
Public Function DoAMPMCal(
  ByVal Loss1 As Variant,
  ByVal Loss2 As Variant,
  ByVal Ftest As Variant
) As String
```

Typical usage
Used to perform an AM to PM calibration. Typically implemented as follows:

```
variable = DoAMPMCal(Loss1, Loss2, Ftest)
```

Action
Performs an AM to PM calibration at the specified frequency. The parameters passed are described in the table below.

Note! AM-PM Calibration should be carried out without the input or output attenuators in place.

Parameter passed	Description	Value	Unit
`Loss1`	Input attenuation / loss		dB
`Loss2`	Output attenuation / loss		dB
`Ftest`	Frequency at which the Cal is done	0.3 to 6080	MHz

Returns

Return values	Type	Executed correctly	Not executed correctly
"`OK`" or "`Error`"	String	"`OK`"	"`Error`"

4.3.12 SetRXQ() - set quiescent point of receiver

```
Public Function SetRXQ() As String
```

Typical usage

```
variable = SetRXQ
```

Action

This function optimizes the quiescent point of the instrument's receiver. This function is not normally necessary unless the ultimate capability of the instrument is required. If used, it must be called immediately before performing a measurement sweep. No parameters are passed.

Parameter passed	Description	Value
None		

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK" or "Error"	String	"OK"	"Error"

4.4 Measurements

4.4.1 SetTrig() - set sweep trigger mode

```
Public Function SetTrig(
  ByVal Para As String
) As String
```

Typical usage
Sets the trigger mode. It is typically called as follows:

```
string-variable = SetTrig(para)
```

Action
Sets the sweep trigger mode to either internal (free running) or externally triggered. The parameter passed is described in the table below.

Parameter passed	Description	Value
para	Mode of trigger	"Free", "Positive", "Negative"

"Free" Normal operation, free running sweep
"Positive" Sweep is synchronized to the rising edge of the external trigger signal
"Negative" Sweep is synchronized to the falling edge of the external trigger signal

External trigger signal specification

Parameter	Units	Min	Max
Low level	V	–0.5	0.8
High level	V	1.5	5.0
Input resistance	kΩ	10	

4.4.2 Measure() - measure one sweep (S11, S21, S11+S21, or 'All' using current calibration)

```
Public Function Measure(
  ByVal Para As Variant
) As String
```

Typical usage
Executes a measurement sweep. It is typically called as follows:

```
variable = Measure(Para)
```

Action
Performs a single measurement sweep using the current calibration. The parameter passed is described in the table below.

Parameter passed	Description	Value
Para	Measurements to be made	"S11", "S21", "S11+S21", "All"

Note! If the current calibration is not for the parameter passed, then an error will be returned. For example, if "S21" is passed, then the current calibration must be either an S21, S11+S21 or 'All' calibration. Similarly, if "S12" is passed, then the current calibration must be an 'All' or 'Alln' calibration.

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK" or "Error"	String	"OK"	"Error"

4.4.3 DoP1dBMeas() - measure P1dB

```
Public Function DoP1dBMeas() As String
```

Typical usage
Used to perform a P1dB measurement.

```
variable = DoP1dBMeas
```

Action
Performs a P1dB measurement. Before this function is used, a P1dB calibration must be carried out at which time the losses at the input and output of the device under test can be set. No parameters are passed.

Parameter passed	Description	Value
None		

Returns

Return values	Type	Executed correctly	Not executed correctly
P1dB value, "No cal" or "Error"	String*	<P1dB Value>	"Error" or "No cal"

*Note: If calibration was done with Ftest parameter set to 0, then frequency sweep plan will be used. In this case, the string returned will have the following format:

<1st frequency pt in MHz>, <P1dB in dBm>, ……, <last frequency pt in MHz>, <P1dB in dBm>

4.4.4 DoAMPMMeas() - measure AM-PM

```
Public Function DoAMPMMeas(
  ByVal Ptest As Variant
) As String
```

Typical usage
Used to carry out an AM to PM coefficient test.

```
variable = DoAMPMMeas(Ptest)
```

Action
Performs a AM to PM measurement. Before using this function, an AM to PM calibration must be done at which time the losses at the input and output of the device under test can be set. A single parameter is passed as described in the table below.

Parameter passed	Description	Value	Unit
`Ptest`	Power level at which measurement reported	–20 to 0	dBm

Returns

Return values	Type	Unit	Executed correctly	Not executed correctly
AM to PM value, "`No cal`" or "`Error`"	String	deg/dB	<AM to PM value>	"`Error`" or "`No cal`"

4.5 Signal processing

4.5.1 SetEnhance() - set enhancement parameters

```
Public Function SetEnhance(
  ByVal Para As Variant,
  ByVal k As Variant
) As String
```

Typical usage
Used to set measurement enhancements.

```
variable = SetEnhance(Para, k)
```

Action
This function is used to set the various measurement enhancements available. Two parameters are passed (“Para” and “k”) as described in the table below.

Note! Frequency Sweep (SetFreqPlan() or SelectCal(), etc.) must be set before this command is used otherwise an error is generated. The set value applies at the next sweep.

Para	Description	Value	Units
“Aver”	Sets number of averages	1 to 255	
“Smoo”	Sets the smoothing	0 to 10	%
“BW”	Sets the measurement bandwidth	10 to 140,000*	Hz
“Powr”	Sets power level	–20 to +6	dBm (0.1 dB steps)
“Dem1”	Sets de-embedding network for port 1	File path and name	
“Dem2”	Sets de-embedding network for port 1	File path and name	
“ApplyDem”	Turns de-embedding on or off	“ON” or “OFF”	
“TDTime”	Sets the start time and stop time for time domain measurements	*See following table	ns
“TDP”	Sets time-domain parameters	*See following table	
“EffD”	Sets the effective dielectric constant of the device under test	1 to 50	

*Valid BW settings are: 10, 50, 100, 500, 1000, 5000, 10000, 15000, 35000, 70000 and 140000

Para	Argument k	Examples	Notes
“TDTime”	<start time>, <stop time> in ns	“-5, 166” “0, 50”	Start time = –5 ns (min) Stop time = 332 ns (max) Maximum span = 166 ns
“TDP”	<dc termination type>, <resistance value (if applicable)>, <window type>, <window order>	“auto,rect” “res,50,kaiserb,6”	Possible terminations: “auto”, “short”, “open”, “res”. "res" value only needed if termination type is "res". Possible window types: “rect”, “kaiserb”, “raisedcos”. "window order" value only needed if window type is "kaiserb".

Returns

Return values	Type	Executed correctly	Not executed correctly
“OK” or “Error”	String	“OK”	“Error”

4.5.2 SetRef() - set reference plane

```
Public Function SetRef(
  ByVal Para As Variant,
  ByVal k As Variant
) As String
```

Typical usage
This function is used to set the measurement reference.

```
variable = SetRef(Para, k)
```

Action
Used to set the reference plane of subsequent measurements. A reference plane for each of the four S-parameters can be specified. Two parameters are passed as described in the table below.

Para	Description	k	Units
"S11", "S21", "S12" or "S22"	Measurement parameter to which the reference plane will apply	<value in the range –10 to +10>, "auto" or "?"	metres

The value of k passed to the function must lie within the range –10 to +10 meters. If k is assigned "auto" then the reference plane will automatically be assigned as follows:

Measurement Parameter	'Automatic' reference plane value assigned
S11 or S22	Distance to a short or an open circuit
S21 or S12	Distance required to produce a mean phase of 0°

Note! Set the reference plane to 0 before using the 'auto' facility.

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK", "No Cal" or "Error"	String	"OK"	"Error", "No cal" or "Error"

Note! The reference plane is reset to zero after calibration. Therefore, if a value other than zero is required, ensure that it is set after calibration

4.5.3 SaveToMem() - save measurement to memory

```
Public Function SaveToMem(
  ByVal Para As Variant
) As String
```

Typical usage
Used to stored measured data to memory.

```
variable = SaveToMem(Para)
```

Action
This function is used to store measured values to memory. A single parameter is passed as shown in the table below.

Para	Description
"S11" or "S21"	Forward parameters
"S22" or "S12"	Reverse parameters

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK" or "Error"	String	"OK"	"Error"

4.5.4 AppMemMath() - apply memory math

```
Public Function AppMemMath(
  ByVal Para As Variant,
  ByVal Func As Variant
) As String
```

Typical usage
Used to apply vector maths to current measured data.

```
variable = AppMemMath(Para, Func)
```

Action
This function is used to apply vector maths to the current measurement only. The parameters passed are described in the table below.

Parameter passed	Description	Values	Comments
`Para`	Measurement parameter	"`S11`", "`S21`", "`S12`" or "`S22`"	S22 and S12 are reverse measurements that require the mode to be set to 'reverse'
`Func`	Vector maths to apply	"`/`", "`+`", "`-`", "`Restore`"	Division, addition and subtraction. "`Restore`" restores the measurement data to that before any math was applied.

Note! If this function needs to be called a second time before carrying out another measurement, use the 'Restore' facility to restore the measurement data.

Returns

Return values	Type	Executed correctly	Not executed correctly
"`OK`" or "`Error`"	String	"`OK`"	"`Error`"

4.5.5 SetSysZo() - set system impedance

```
Public Function SetSysZo(
  ByVal SysZo As Integer,
  ByVal ExMatch As Variant
) As String
```

Action
This function is used to set the system impedance Z_0. The parameters passed as described in the table below.

Parameter passed	Description	Values	Comments
SysZo	System impedance	10 to 200	Only real impedance values
ExMatch	Flag indicating if external impedance matching networks are being used	-	If "True", it is assumed external components are performing the impedance conversion. If "False", the software will perform mathematical conversion from 50 Ω to the requested value.

Note: If external impedance matching networks are being used, then a suitable calibration kit should be used to calibrate. For example, to measure a 75 Ω device, 75 Ω to 50 Ω matching pads could be used and calibration carried out using a 75 Ω calibration kit. If no impedance matching networks are used, it is assumed that calibration is carried out using a 50 Ω calibration kit. The software then mathematically converts the measurements to 75 Ω. Please refer to the *User's Guide* for further information. When applied, data stored in memory is unaffected.

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK" or "Error"	String	"OK"	"Error"

4.5.6 ZConversion() - impedance conversion utility

```
Public Function ZConversion (
  ByVal ZoOld As Variant,
  ByVal ZoNew As Variant,
  ByVal A11R As Variant,
  A11I As Variant,
  A21R As Double,
  A21I As Variant,
  A12R As Variant,
  A12I As Variant,
  A22R As Double,
  A22I As Variant
) As String
```

Action
This function is used to convert normalized S-parameters to a different impedance. The parameters passed are described in the table below.

Parameter passed	Description	Values	Comments
`Zold`	Base impedance of S-parameters to be converted	10 to 200	Only real impedance values
`ZoNew`	Base impedance of converted S-parameters	10 to 200	Only real impedance values
`A11R, A11I`	Real and imaginary parts of S11	-	Normalized values
`A21R, A21I`	Real and imaginary parts of S21	-	Normalized values
`A12R, A12I`	Real and imaginary parts of S12	-	Normalized values
`A22R, A22I`	Real and imaginary parts of S22	-	Normalized values

Note: The function requires that a full set of s-parameters is passed, i.e. a total of 8 terms representing the real and imaginary parts of each parameter. If a full set is not available, then missing parameters must be given default values. Possible values for any parameter not available are 10^{-6}, j0.0. Please be aware that all S-parameters are interrelated so in some circumstances this assumption may not yield best results.

Returns

Return values	Type	Executed correctly	Not executed correctly
<string value> or "`Error`"	String	"`S11real, S11imag, S21real, S21imag, S12real, S12imag, S22real, S22imag`"	"`Error`"

4.6 Get processed data

4.6.1 GetData() - get data

```
Public Function GetData(
  ByVal Para As Variant,
  ByVal MeasType As Variant,
  ByVal Pnt As Variant
) As String
```

Typical usage
Used to get measured data (one frequency point per call) in a specified format.

```
variable = GetData(Para, MeasType, Pnt)
```

Action
This function is used to get measured data in a specified format. The parameters required to be passed are shown in the table below.

Parameter passed	Description	Values	Comments
`Para`	Measurement parameter	"`S11`", "`S21`", "`S12`" or "`S22`"	S22 and S12 are reverse measurements that require the mode to be set to 'reverse'
`MeasType`	Required data format	"`real`", "`imag`", "`logmag`", "`phase`", "`swr`", "`gd`", "`td`"	The available formats are: real, imaginary, log magnitude, phase, standing wave ratio, group delay, time domain
`Pnt`	Frequency index or time point in CW or TC mode	<frequency index>	Typically a value between 1 and the number of sweep points. 0 or less returns the entire sweep points in comma separated string

Returns

Mode	Return values	Type	Executed correctly	Not executed correctly
Frequency sweep	<string value> or "`Error`"	String	<frequency (Hz)>, <parameter value>	"`Error`"
CW (time sweep)	<string value> or "`Error`"	String	<time (s)>, <parameter value>	"`Error`"
TD (time domain)	<string value> or "`Error`"	String	<time (s)>, <parameter value>	"`Error`"

4.6.2 GetMem() - get memory

```
Public Function GetMem(
  ByVal Para As Variant,
  ByVal MeasType As Variant,
  ByVal Pnt As Variant
) As String
```

Typical usage
Used to get memory data (one frequency point per call) in a specified format.

```
variable = GetMem(Para, MeasType, Pnt)
```

Action
This function is used to get measured data in a specified format. The parameters required to be passed are shown in the table below.

Parameter passed	Description	Values	Comments
`Para`	Measurement parameter	"`S11`", "`S21`", "`S12`" or "`S22`"	S22 and S12 are reverse measurements that require the mode to be set to 'reverse'
`MeasType`	Required data format	"`real`", "`imag`", "`logmag`", "`phase`", "`swr`", "`gd`", "`td`"	The available formats are: real, imaginary, log magnitude, phase, standing wave ratio, group delay, time domain
`Pnt`	Frequency index	<frequency index>	A value between 1 and the number of sweep points.

Returns

Return values	Type	Executed correctly	Not executed correctly
<string value> or "`Error`"	String	"<frequency (Hz)>, <parameter value>"	"`Error`"

Note! Smoothing is not applied to returned memory data.

4.6.3 FndPt() - find data point

```
Public Function FndPt(
  ByVal Freq As Variant,
  ByVal Para As Variant,
  ByVal MeasType As Variant,
  ByVal Func As Variant
) As String
```

Typical usage
Gets data in a specified format. Includes facility for finding the peak or minimum value and 3 or 6 dB bandwidth.

```
variable = FndPt(freq, Para, MeasType, Func)
```

Action
This function is used to get measured data in a specified format. It can be considered as a marker function. It is similar to GetData() except that instead of a frequency index, a frequency value (in MHz) is passed. In addition, a parameter can be specified to find the peak or minimum value as well as the 3 or 6 dB bandwidth points. Note that in both cases this will return the measurement points nearest the requested points. The parameters required to be passed are shown in the table below.

Parameter passed	Description	Values	Comments
Freq	Frequency in MHz	<frequency>	A value between 0.3 and 6080 (MHz).
Para	Measurement parameter	"S11", "S21", "S12" or "S22"	S22 and S12 are reverse measurements that require the mode to be set to 'reverse'
MeasType	Required data format	"real", "imag", "logmag", "phase", "swr", "gd", "td"	The available formats are: real, imaginary, log magnitude, phase, standing wave ratio, group delay, time domain
Func	'Marker' function required	"normal", "pk", "min", "-3dB", "-6dB", "+3dB", "+6dB"	'Normal' returns the value at the specified frequency. 'pk' and 'min' find the peak and minimum values, respectively. The other values specified a bandwidth, such as "-3 dB" refers to the –3 dB bandwidth.

Returns

Return values	Type	Executed correctly	Not executed correctly
<string value> or "Error"	String	"<frequency (Hz)>, < (pk, min, etc) value>, <bandwidth value>, <frequency index>"	"Error"

Note! Frequency index is an integer representing the point in the sweep.

4.6.4 SetLimits() - set pass/fail limits

```
Public Function SetLimits(
  ByVal Segment As Integer,
  ByVal Para As String,
  ByVal FreqLow As Variant,
  ByVal FreqHigh As Variant,
  ByVal Min As Variant,
  ByVal Max As Variant
) As String
```

Typical usage
Sets the minimum and maximum pass / fail limits. Up to 8 segments may be specified.

```
variable = SetLimits(Segment, Para, FreqLow, FreqHigh, ValMin, ValMax)
```

Action
This function is used to set segments of the pass/fail limits. It is possible to specify up to 8 segments for each measurement parameter (S11, S21, S12 or S22). The parameters required to be passed are described in the table below.

Parameter passed	Description	Values	Comments
`Segment`	Segment identifier	1 to 8	
`Para`	Measurement parameter	"`S11`", "`S21`", "`S12`" or "`S22`"	S22 and S12 are reverse measurements that require the mode to be set to 'reverse'
`FreqLow`	Start frequency of segment in MHz	0.3 to 6080 or "`?`" or "`Reset`"	The start frequency of the segment must lie within the calibration frequency band. It must be less than the stop frequency. If `FreqLow` is set to a string = "`?`" then the set values of the segment will be returned. Similarly, if it is set to a string = "`Reset`" the segment is initialized.
`FreqHigh`	Stop frequency of segment in MHz	0.3 to 6080	The stop frequency of the segment must lie within the calibration frequency band. It must be greater than the start frequency.
`ValMin`	Minimum value limit of segment	–1E9 to 1E9	
`ValMax`	Maximum value limit of segment	–1E9 to 1E9	

Returns

Return values	Type	Executed correctly	Not executed correctly
<string value> or "`Error`"	String	"`OK`" or if query, "<start freq (Hz)>, < stop freq (Hz) >, <min value>, <max value>"	"`Error`"

4.6.5 TestLimits() - pass/fail measurement

```
Public Function TestLimits(
  ByVal Para As String,
  ByVal FreqLow As Variant,
  ByVal FreqHigh As Variant,
  ByVal MeasType As Variant
) As String
```

Typical usage
Compares current measurement against the set pass/fail limits. All 8 segments are checked.

```
variable = TestLimits(Para, FreqLow, FreqHigh, MeasType)
```

Action
This function is used to test against the pass / fail limits. The parameter (S11, S21, S12 or S22) needs to be specified together with type of measurement. The parameters required to be passed are described in the table below.

Parameter passed	Description	Values	Comments
`Para`	Measurement parameter	"`S11`", "`S21`", "`S12`" or "`S22`"	S22 and S12 are reverse measurements that require the mode to be set to 'reverse'
`FreqLow`	Start frequency of test band in MHz	0.3 to 6080 or 0	The start frequency of the test band in MHz. If set to 0, then the current calibration's entire band is used to perform the pass / fail test.
`FreqHigh`	Stop frequency of test band in MHz	0.3 to 6080	The stop frequency of the test band in MHz.
`MeasType`	Required data format	"`real`", "`imag`", "`logmag`", "`phase`", "`swr`", "`gd`", "`td`"	The available formats are: real, imaginary, log magnitude, phase, standing wave ratio, group delay, time domain

Returns

Return values	Type	Executed correctly	Not executed correctly
<string value> or "`Error`"	String	"`Pass`" or if test fail, "<fail freq (Hz)>, < "`Max` (or `Min`) `limit =`" ValMin (or ValMax)>, <"`Actual =`">, <Measured value>"	"`Error`"

4.7 Get info

4.7.1 GetInfo() - get instrument/cal information

```
Public Function GetInfo(
  ByVal Para As Variant
) As String
```

Typical usage
This function is used to get data related to the instrument status. A single parameter is passed to the function as described in the table below.

```
variable = GetInfo(Para)
```

Para	Description	Valid return
"ApplyDem"	Flag indicating if de-embedding is on or off	Returns “On” or “Off” to indicate if de-embedding is applied or not
'"AverSet"	Number of averages set	1 to 255
"BWSet"	Bandwidth set	10 to 140000
"CalType"	Calibration type set	“S11+S21”, “S11”, “S21”, “12 Term”
"CalPower"	Signal power used during calibration	–20 to 0 (dBm)
"CalAver"	Averages used in calibration	1 to 16
"CalKit1" or “Calkit2”	Cal kit name loaded for port 1 or port 2	<cal kit name used>
“CWMode”	CW time sweep mode	“False” or “True”
"CFreqPlan”	Queries the Frequency plan used for calibration	Returns a comma-separated string with the frequency plan used. Frequency values returned are in Hz. <start freq>, <stop freq>, <step freq>, <# of sweep points>, <test level>.
"Dem1"	De-embedding network for port 1 loaded or not flag	Returns “Loaded” or “Not loaded” if network for port 1 has been loaded or not.
"Dem2"	De-embedding network (port 2) loaded or not	Returns “Loaded” or “Not loaded” to indicate if de-embedding network for port 2 has been loaded
"ErrFlag"	Read serial comms Error flag	String. Typically “Error” or “OK”
"ExMatch"	Queries if external impedance matching	Returns a string, "1" if networks used otherwise "0"
“RefP”	Reference plane in use	Value of reference plane in meters and effective dielectric constant
"FreqPlan”	Queries the Frequency plan set	Returns a comma-separated string with the current frequency plan. For normal sweep operation frequency values returned are in Hz. <start freq>, <stop freq>, <step freq>, <# of sweep points>, <test level>. In CW time sweep, values returned are <CW freq>, <# of sweep points>, <test level>,<time between pts in ms>.

“Interpol”	Queries if calibration being used is interpolated from another	Returns “Yes” or “No”
”KitSex1” or “KitSex2”	Port 1 or port 2 cal kit sex	“Male” or “Female”
”KitC1” or “KitC2”	Cal kit capacitance coefficients for port 1 kit or port 2 kit	<coefficient 0,coefficient 1, coefficient 2, coefficient 3>
“KitInd1” or “KitInd2”	Cal kit Short circuit inductance for port 1 kit or port 2 kit	<inductance>
”KitOpenOff1” or “KitOpenOff2”	Port 1 or port 2 cal kit Open reference plane	Reference plane of kit in meters and seconds
”KitShortOff1” or “KitShortOff2”	Port 1 or port 2 cal kit Short reference plane	Reference plane of kit in meters and seconds
”KitOpenOffLoss1” or “KitOpenOffLoss2”	Port 1 or port 2 cal kit Open offset loss	Open offset loss in GΩ/s
”KitShortOffLoss1” or “KitShortOffLoss2”	Port 1 or port 2 cal kit Short offset loss	Short offset loss in GΩ/s
”KitL1” or “KitL2”	Port 1 or port 2 cal kit load reflection data flag	Returns 1 if data available or 0 if no data available (considered perfect load)
”KitD1” or “KitD2”	Port 1 or port 2 cal kit load reflection data	Comma-separated string as follows. <# points, frequency (MHz), real part, imaginary part,…>
“Kit1T”	Port 1 cal kit Thru data flag	Returns 1 if data available or 0 if no data available
“Kit1TD”	Port 1 cal kit Thru data (s-parameters)	Comma-separated string as follows. <# points, frequency (MHz), S11r, S11i, S21r, S21i,S12r,S12i,S22r,S22i
"Model"	Instrument model	String. Typically “PicoVNA 106”
"TDP"	Time domain parameters	Returns a comma-separated string with the following data: <Start Time>, <Stop Time>, <Step Time>, <Termination type>,<Res value if applicable>, <Window type>, <Window order (if applicable)>
"SmooSet"	Smoothing set	0 to 10 (%)
"SN"	Instrument serial number	String. Typically a four digit number.
“HWSN”	Hardware serial number	String. Typically 8 characters long
"Stat"	Instrument status	String: “R”: Ready, “S”: Ready from power up, “E”: Error
“SysZo”	Queries the system impedance set	Returns a string <SysZo>
"Temp"	Instrument temperature	String. <Temp deg C> or “0” if an error is encountered.

Returns
According to the table above or “Error” if an error has been encountered.

4.8 Data storage

4.8.1 SaveKit() - save cal kit

```
Public Function SaveKit(
  ByVal FileName As Variant,
  ByVal port As Integer
) As String
```

Typical usage
This function is used to save the calibration kit on disk. The parameter passed is described in the table below.

```
variable = SaveKit(FileName, port)
```

Parameter passed	Description	Values	Comments
FileName	File name	<path + file name>	The file name must include the full path name
Port	Port to which kit applies	"1" or "2"	

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK" or "File Error"	String	"OK"	"File Error"

Important: Through adaptor data is only loaded and saved when the kit is associated with Port 1 of the instrument. A kit with Thru data may be loaded to Port 2 but the Thru data will be ignored, therefore, if the kit is subsequently re-saved the Thru data will be lost.

4.8.2 SelectSaveMeas() - save measurement

```
Public Sub SelectSaveMeas()
```

Typical usage
This routine is called to save measured data. When called, a dialog is displayed that allows the user to select the data and format to be saved as well as the destination file.

No parameters are passed or returned.

4.8.3 SaveCal() - save status and calibration

Note! Calibration and status files saved using the remote control DLL are not compatible with those saved using the PicoVNA 2 software.

```
Public Function SaveCal(
  ByVal FileName As Variant
) As String
```

Typical usage
This function is used to save the current calibration and status. A single parameter is passed as described in the table below.

```
variable = SaveCal(FileName)
```

Parameter passed	Description	Values	Comments
FileName	File name or "?"	<path + file name> or "?"	The file name must include the full path name. If a "?" is passed, a dialog is displayed to allow the user to interactively save the calibration and status.

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK" or "Error writing file"	String	"OK"	"Error writing file"

4.9 Data retrieval

4.9.1 LoadCal() - load status and calibration

```
Public Function LoadCal(
  ByVal FileName As Variant
) As String
```

Typical usage
This function is used to load a calibration and status file. A single parameter is passed as described in the table below.

```
variable = LoadCal(FileName)
```

Parameter passed	Description	Values	Comments
FileName	File name or "?"	<path + file name> or <"?">	The file name must include the full path name. If a "?" is passed, a dialog is displayed to allow the user to interactively load a calibration and status file.

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK" or "Error reading file"	String	"OK"	"Error reading file"

4.10 Miscellaneous

4.10.1 InitVar() - initialize all variables

```
Public Function InitVar() as String
```

Typical usage
This function is called to initialize all internal variables.

```
variable = InitVar
```

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK"	String	"OK"	Not applicable

4.10.2 SelectSigGen() - set to signal generator mode [dialog]

```
Public Sub SelectSigGen()
```

Typical usage
This routine is called to display a dialog that allows the user to set the instrument up as synthesized signal generator.

```
Call SelectSigGen
```

or

```
SelectSigGen
```

Returns
No parameters are passed or returned.

4.10.3 SetSigGen() - set to signal generator mode

```
Public Function SetSigGen(
  ByVal mode as Variant,
  ByVal P1 As Variant,
  ByVal P2 As Variant
) As String
```

Typical usage
This function is used to set up the instrument as synthesized signal generator. The parameters passed are described in the table below.

```
variable = SetSigGen("CW", freq, power)
```

Mode	Parameter passed	Description	Values	Comments
"CW"	freq	Frequency in MHz	<frequency>	Must be within range 0.3 to 6080
	power	Power in dBm	<power>	Must be within range –20 to 6

Returns

Return values	Type	Executed correctly	Not executed correctly
"OK" or "Error"	String	"OK"	"Error"

Note: Setting P2 (power in dBm) to –100 will have the effect of switching off the signal generator output

4.10.4 DLLVer() - get DLL program version

```
Public Function DLLVer() As String
```

Typical usage
This function is used to query the DLL program version. No parameters are passed.

```
variable = DLLVer
```

Returns

Return values	Type	Executed correctly	Comments
<version>	String	<version>	Example: "V1.0 Jan 2014"

4.11 Diagnostics

4.11.1 InsDiag() - run diagnostics tests [dialog]

```
Public Function InsDiag() As String
```

Typical usage
This function is used to display a dialog that allows the user to carry out instrument diagnostics tests. No parameters are passed.

```
variable = InsDiag
```

Returns

Return values	Type	Executed correctly	Not executed (aborted)
<string>	String	"Tests completed"	"Tests not performed"

5 Glossary

AM to PM. Amplitude modulation to phase modulation conversion. An undesirable effect in which changes in amplitude in a system cause changes in phase. This can cause data errors in a digital system.

Calibration. A procedure for testing the VNA at regular intervals to measure its inherent errors. These errors are then subtracted from the measurements made on the DUT to obtain a more accurate result.

Calibration kit. To remove errors caused by impedance mismatches and nonlinearities in the VNA and its associated cables and connectors, it must be calibrated at frequent intervals. A calibration kit, consisting of some combination of short circuit, open circuit, known load, and through-adaptors, is required for this process. The calibration kit has known electrical parameters that must be stored in the VNA software.

CW. Continuous wave. A fixed-amplitude sine wave.

DLL. Dynamic link library. A collection of functions that can be called to control the VNA and retrieve data from it. The functions can be called from Microsoft VBA and other compatible programming languages.

DUT. Device under test. The component or system connected through cables and adaptors to the VNA's test ports.

EEPROM. Electrically erasable read-only memory. A memory device inside the VNA that stores configuration information such as the device's serial number.

Frequency plan. A list of frequencies and power levels that the VNA will generate during the test.

Impedance. The system impedance (Z_0) is assumed to match that of the VNA, which is 50 Ω. If it does not, the VNA can compensate for the actual system impedance.

P1dB. 1 dB gain compression point. An ideal DUT has constant gain regardless of the power level applied to it. In practice, the gain tends to decrease at higher power levels. P1dB is the input power level at which the gain drops by 1 dB from its nominal value.

Sweep trigger. The frequency sweep generated by the VNA can be free-running or synchronized to an external signal. In the latter case, the frequency sweep starts when the VNA is triggered by the external signal.

Reference plane. A location somewhere between the VNA output and the DUT input used as the zero reference for measuring distance. It can be adjusted by the software to account for the effect of adding through adaptors.

Through. An adaptor that does not intentionally modify the signal passing through it but functions only to adapt the connector on one device to fit another device.

VNA. Vector network analyzer. A measuring instrument that drives a swept sine wave test signal into one port of a device under test (DUT) and measures the reflected (and optionally transmitted) signals. It uses these measurements to calculate the DUT's S-parameters.

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