4

Programming and Documentation Conventions

Introduction

This chapter covers conventions which are used in programming the instrument, as well as conventions used in the remainder of this manual. This chapter contains a detailed description of the command tree and command tree traversal. For more information on command syntax refer to chapter 27, "Message Communication and System Functions."

Truncation Rules

The truncation rule for the mnemonics used in headers and alpha arguments is:

The mnemonic is the first four characters of the keyword unless:

The fourth character is a vowel, then the mnemonic is the first three characters of the keyword.

This rule is not used if the length of the keyword is exactly four characters.

Some examples of how the truncation rule is applied to various commands are shown in table 4-1.

Table 4-1. Mnemonic Truncation

Long Form	Short Form
RANGE	RANG
PATTERN	PATT
TIME	TIME
DELAY	DEL

Front Panel to Command Cross-Reference

Table 4-2 lists the front-panel functions for the oscilloscope in alphabetical order with their corresponding programming commands.

Table 4-2. Front-Panel Function to Command Cross-Reference

Front-Panel Function	Location	Command
1|2|3|4|EXT	Channel menu	:BLANk
1|2|3|4|EXT	Channel menu	:CHANnel[:DISPlay]
1|2|3|4|EXT	Channel menu	:VIEW
1|2|3|4|EXT	Delay Trigger menu (edge)	:TRIGger:DELay:SOURce
1|2|3|4|EXT|LINE	Edge Trigger menu	:TRIGger:SOURce
1|2|3|4|EXT	State Trigger menu	:TRIGger:SOURce
1 MΩ|50Ω DC	Channel menu	:TRIGger:COUPling
525|625 lines	TV Trigger menu	:TRIGger:LINE
Δt ΔV	Marker menu	:MARKer:XDELta
Δt ΔV	Marker menu	:MEASure:TDELta
Δt ΔV	Marker menu	:MARKer:YDELta
Δt ΔV	Marker menu	:MEASure:VDELta
Δt ΔV	front-panel key	:MENU:DELTa
Δt markers	Marker menu	:DISPlay:TMARker
Δt markers	Marker menu	:MARKer[:DISPlay]
Δt markers	Marker menu	:MEASure:ESTArt
Δt markers	Marker menu	:MEASure:ESTOp
Δt markers	Marker menu	:MARKer:X1Position
Δt markers	Marker menu	:MEASure:TSTArt
Δt markers	Marker menu	:MARKer:X2Position
Δt markers	Marker menu	:MEASure:TSTOp
ΔV markers	Marker menu	:DISPlay:VMARker
ΔV markers	Marker menu	:MARKer[:DISPlay]
ΔV markers	Marker menu	:MARKer:Y1Position
ΔV markers	Marker menu	:MEASure:VSTArt
ΔV markers	Marker menu	:MARKer:Y2Position
ΔV markers	Marker menu	:MEASure:VSTOp
-|subtract	Waveform Math menu	:FUNCtion:SUBTract
- WIDTH	front-panel key	:MEASure:NWIDth
# of avg	Display menu (avg)	:ACQuire:COUNt
# of points	Timebase menu	:SEQuential:NPOints
# of points	Waveform Math menu (FFT)	:FUNCtion:POINts

Table 4-2. Front-Panel Function to Command Cross-Reference

Front-Panel Function	Location	Command
# of screens	Display menu	:DISPlay:FORMat
# of segments	Display menu (avg single-shot)	:ACQuire:TYPE
# of segments	Timebase menu	:SEQuential:NSEGments
%|volts	Define Meas menu (meas def)	:MEASure:UNITs
+|add	Waveform Math menu	:FUNCtion:ADD
+ WIDTH	front-panel key	:MEASure:PWIDth
↑|X|X|X	Delay Trigger menu (state)	:TRIGger:LOGic
↑|X|X|X	State Trigger menu	:TRIGger:LOGic
AC BNC	Utility menu	:BNC
ac|dc	Channel menu	:CHANnel:COUPling
add|+	Waveform Math menu	:FUNCtion:ADD
address	Utility menu (HP-IB menu)	(front panel only)
addressed|talk only	Utility menu (HP-IB menu)	program language specific
add to memory	Waveform Save menu (pixel)	:MERGe
add to memory	Waveform Save menu (pixel)	:PMEMory:MERGe
adjust	Edge Trigger menu	:TRIGger:LEVel
adjust	Glitch Trigger menu	:TRIGger:GLITch:LEVel
after fail	Define Meas menu (compare)	:MEAS:WCOM:POSTfailure
after fail	Define Meas menu (meas limit)	:MEASure:POSTfailure
allowance	Define Meas menu (compare)	:MEAS:WCOM:ALLowance
attenuation	Utility menu (probe cal menu)	(front panel only)
AUTOSCALE	front-panel key	:AUToscale
auto|trig'd	Trigger menu	:TIMebase:MODE
avg|env|norm	Display menu	:ACQuire:TYPE
axes|grid|off|frame	Display menu	:DISPlay:GRATicule
BW lim	Channel menu	:CHANnel:HFReject
center	Edge Trigger menu	:TRIGger:CENTered
center	Glitch Trigger menu	:TRIGger:GLITch:CENTered
center freq	Waveform Math menu (FFT)	:FUNCtion:FREQ
CHAN	front-panel key	:MENU:CHANnel
channel	Utility menu (probe cal menu)	:CALibrate:TNULl
CLEAR DISPLAY	front-panel key	:ERASe pmem0
clear memory	Waveform Save menu (pixel)	:ERASe
clicker	Utility menu	:BEEPer
clock	Delay Trigger menu (state)	:TRIGger:DELay:SOURce
clock	State Trigger menu	:TRIGger:SOURce
CLR MEAS	front-panel key	:MEASure:SCRatch
color	Utility menu (HP-IB menu)	:HARDcopy:PLOT:COLor
compare	Define Meas menu (compare)	:MEAS:WCOMpare:COMPare
connect dots	Display menu	:DISPlay:CONNect

Table 4-2. Front-Panel Function to Command Cross-Reference

Front-Panel Function	Location	Command
continuous	Define Meas menu (meas)	(see specific measurement)
count	Delay Trigger menu	:TRIGger:OCCurrence
date	Utility menu (system menu)	:SYSTem:DATE
dc|ac	Channel menu	:CHANnel:COUPling
define	Define Meas menu	:MEASure:DEFine
DEFINE MEAS	front-panel key	:MENU:MEASure
delay| + width|- width	Define Meas menu (meas def)	:MEASure:DEFine
DELAY	front-panel key	:MEASure:DELay
delay	Timebase menu	:TIMebase:DELay
delay	Delay Trigger menu	:TRIGger:DELay
delay	Waveform Save menu (waveform)	:WMEMory:XOFFset
delay|tv|edge|pattern|state	Trigger menu	:TRIGger:MODE
delta t (x) delta v (y)|Δt ΔV	Marker menu	:MARKer:XDELta
delta t (x) delta v (y)|Δt ΔV	Marker menu	:MEASure:TDELta
delta t (x) delta v (y)|Δt ΔV	Marker menu	:MARKer:YDELta
delta t (x) delta v (y)|Δt ΔV	Marker menu	:MEASure:VDELta
delta t (x) delta v (y)|Δt ΔV	Marker menu	:MENU DELTa
delta t (x) markers	Marker menu	:DISPlay:TMARker
delta t (x) markers	Marker menu	:MARKer[:DISPlay]
delta t (x) markers	Marker menu	:MEASure:ESTArt
delta t (x) markers	Marker menu	:MEASure:ESTOp
delta t (x) markers	Marker menu	:MARKer:X1Position
delta t (x) markers	Marker menu	:MEASure:TSTArt
delta t (x) markers	Marker menu	:MARKer:X2Position
delta t (x) markers	Marker menu	:MEASure:TSTOp
delta V (y) markers	Marker menu	:DISPlay:VMARker
delta V (y) markers	Marker menu	:MARKer[:DISPlay]
delta V (y) markers	Marker menu	:MARKer:Y1Position
delta V (y) markers	Marker menu	:MEASure:VSTArt
delta V (y) markers	Marker menu	:MARKer:Y2Position
delta V (y) markers	Marker menu	:MEASure:VSTOp
device mode	Utility menu (HP-IB menu)	:HARDcopy:MODE
device mode	Utility menu	:PLOT
device mode	Utility menu	:PRINt
diff	Waveform Math menu	:FUNCtion:DIFF
DISPLAY	front-panel key	:MENU DISPlay
display off	Waveform Math menu	:FUNCtion[:DISPlay]
display off	Waveform Math menu	:BLANk
display off	Waveform Save menu	:BLANk

Table 4-2. Front-Panel Function to Command Cross-Reference

Front-Panel Function	Location	Command
display off	Waveform Save menu (pixel)	:PMEMory[:DISPlay]
display off	Waveform Save menu (waveform)	:WMEMory[:DISPlay]
display on	Waveform Math menu	:FUNCtion[:DISPlay]
display on	Waveform Math menu	:VIEW
display on	Waveform Save menu	:VIEW
display on	Waveform Save menu (pixel)	:PMEMory[:DISPlay]
display on	Waveform Save menu (waveform)	:WMEMory[:DISPlay]
DUTY CY	front-panel key	:MEASure:DUTycycle
ECL	Channel menu	:CHANnel:ECL
edge | pattern | state | delay | tv	Trigger menu	:TRIGger:MODE
enter changes	Display menu (seq single-shot)	front panel only
env | norm | avg	Display menu	:ACQuire:TYPE
exclude	Display menu (seq single-shot)	:SEQuential:EXCLude
execute changes	Display menu (seq single-shot)	front panel only
fail if >	Define Meas menu (meas limit)	:MEASure:COMPare
failure #	Waveform Save menu (multiple)	:MMEMory:FNUMber
FALLTIME	front-panel key	:MEASure:FALLtime
FFT	Waveform Math menu	:FUNCtion:FFT
field	TV Trigger menu	:TRIGger:FIELd
FINE	front-panel key	(front panel only)
f1 | f2 | f3 | f4	Waveform Math menu	:FUNCtion < n >
form feed	Utility menu (HP-IB menu)	:HARDcopy:PAGE
frame | axes | grid | off	Display menu	DISPlay:GRATicule
freq span	Waveform Math menu (FFT)	:FUNCtion:SPAN
FREQ	front-panel key	:MEASure:FREQuency
from	Define Meas menu (meas def)	:MEASure:DEFine
from	Display menu (seq single-shot)	:SEQuential:EXCLude
from	Display menu (seq single-shot)	:SEQuential:INCLude
grid | off | frame | axes	Display menu	DISPlay:GRATicule
HARDCOPY	front-panel key	:PLOT
HARDCOPY	front-panel key	:PRINt
H | X | X | X	Delay Trigger menu (pattern)	:TRIGger:LOGic
H | X | X | X	Pattern Trigger menu	:TRIGger:LOGic
holdoff	Edge Trigger menu	:TRIGger:HOLDoff
holdoff	Glitch Trigger menu	:TRIGger:GLITch:HOLDoff
holdoff	Pattern Trigger menu	:TRIGger:HOLDoff
holdoff	State Trigger menu	:TRIGger:HOLDoff

Table 4-2. Front-Panel Function to Command Cross-Reference

Front-Panel Function	Location	Command
holdoff	TV Trigger menu	:TRIGger:HOLDoff
horix magnify	Waveform Math menu (FFT)	:FUNCtion:MAGNify
HP-IB menu	Utility menu	(see specific functions)
include	Display menu (seq single-shot)	:SEQuential:INCLude
initialize	Utility menu (HP-IB menu)	:HARDcopy:PLOT:INITialize
int	Waveform Math menu	:FUNCtion:INTegrate
interpolation	Utility menu (system menu)	front panel only
inv	Waveform Math menu	:FUNCtion:INVert
level	Edge Trigger menu	:TRIGger:LEVel
level	Glitch Trigger menu	:GLITch:TRIGger:LEVel
level	TV Trigger menu	:TRIGger:LEVel
LF rej	Channel menu	:CHANnel:LFReject
limit	Define Meas menu	:MEASure:COMPare
line	TV Trigger menu	:TRIGger:OCCurrence
LOCAL	front-panel key	:SYSTem:KEY
lower threshold	Define Meas menu (meas def)	:MEASure:LOWer
magnify	Waveform Math menu	:FUNCtion:MAGNify
marker menu on off	Marker menu	:MARKer[:DISPlay]
mask menu	Waveform Save menu	front panel only
measure	Define Meas menu	(see specific functions)
measurements	Define Meas menu (meas def)	(see specific measurements)
multiply|X	Waveform Math menu	:FUNCtion:MULTiply
noise reject	Edge Trigger menu	:TRIGger:SENSitivity
nonvolatile	Waveform Save menu (waveform/multiple)	:STORe
norm|avg|env	Display menu	:ACQuire:TYPE
off on	Channel menu	:CHANnel[:DISPlay]
off|frame|axes|grid	Display menu	DISPlay:GRATicule
offset	Channel menu	:CHANnel:OFFSet
offset	Waveform Math menu	:FUNCtion:OFFSet
on fail, save	Define Meas menu (compare)	:MEAS:WCOMP:DESTination
on fail, save	Define Meas menu (meas limit)	:MEASure:DESTination
or if <	Define Meas menu (meas limit)	:MEASure:COMPare
paper length	Utility menu (HP-IB menu)	:HARDcopy:LENGth
pattern|state|delay|tv|edge	Trigger menu	:TRIGger:MODE
peak search	Waveform Math menu (FFT)	:FUNCtion:PEAK
pen	Utility menu (HP-IB)	:HARDcopy:PLOT:PEN
PERIOD	front-panel key	:MEASure:PERiod
persistence	Display menu (norm)	:DISPlay:PERSistence
pixel	Waveform Save menu	:MERGe

Table 4-2. Front-Panel Function to Command Cross-Reference

Front-Panel Function	Location	Command
polarity	TV Trigger menu	:TRIGger:POLarity
plot	Utility menu (HP-IB menu)	:HARDcopy:PLOT:AREA
present	State Trigger menu	:TRIGger:CONDition
probe	Channel menu	:CHANnel:PROBe
probe cal menu	Utility menu	(see specific functions)
protect	Waveform Save menu (multiple)	:MMEMory:PROTect
protect	Waveform Save menu (waveform)	:WMEMory:PROTect
qualify on	Delay Trigger menu	:TRIGger:QUALify
qualify on	TV Trigger menu	:TRIGger:QUALify
realtime | repetitive	Timebase menu	:TIMebase:SAMPle
RECALL	front-panel key	*RCL
RECALL / CLEAR	front-panel keys	*RST
reference	Timebase menu	:TIMebase:REFerence
registration form	Utility menu (system menu)	front panel only
repetitive | realtime	Timebase menu	:TIMebase:SAMPle
RISETIME	front-panel key	:MEASure:RISetime
rms	Define Meas menu (meas)	:MEASure:VACRms
rms	Define Meas menu (meas)	:MEASure:VDCRms
rms	Define Meas menu (meas)	:MEASure:VRMS
RUN/STOP	front-panel key	:RUN
RUN/STOP	front-panel key	:STOP
SAVE	front-panel key	*SAV
saved source	Waveform Save menu (multiple)	:MMEMory:SOURce
scale-delay	Waveform Save menu	:WMEMory:XOFFset
scale-timebase	Waveform Save menu	:WMEMory:XRANge
s/div	Timebase menu	:TIMebase:RANGe
search level	Waveform Math menu (FFT)	:FUNCtion:LEVel
seconds | s	Utility menu (probe cal menu)	:CALibrate:TNULl
seconds per division	Timebase menu	:TIMebase:RANGe
segment #	Display menu (norm seq single-shot)	:SEQuential:NSEGments
self cal menu	Utility menu	(front panel only)
selftest menu	Utility menu	*TST
sensitivity	Waveform Math menu	:FUNCtion:RANGe
sequential	Timebase menu	:SEQuential[:DISPlay]
service menu	Utility menu	(front panel only)
set	Define Meas menu (meas limit)	(see specific measurements)

Table 4-2. Front-Panel Function to Command Cross-Reference

Front-Panel Function	Location	Command
SHOW	front-panel key	:MENU SHOW
SINGLE	front-panel key	:TIMebase:MODE
slope	Delay Trigger menu	:TRIGger:DELay:SLOPe
slope	Edge Trigger menu	:TRIGger:SLOPe
source	Display menu (seq single-shot)	:SEQuential:SOURce
source	Edge Trigger menu	:TRIGger:SOURce
source	Marker menu	:MARKer:X1Y1source
source	Marker menu	:MARKer:X2Y2source
source	TV Trigger menu	:TRIGger:SOURce
source	Waveform Save menu (waveform)	:STORe
source-state	Glitch Trigger menu	:GLITch:TRIGger:SOURce
standard	Define Meas menu (meas def)	:MEASure:MODE
start cal	Utility menu (probe cal menu)	(front panel only)
start marker	Marker menu	:MARKER:X1Position
start marker	Marker menu	:MEASure:ESTArt
start marker	Marker menu	:MEASure:TSTArt
state|delay|tv|edge|pattern	Trigger menu	:TRIGger:MODE
statistics	Define Meas menu (meas)	:MEASure:STATistics
stop marker	Marker menu	:MARKer:X2Position
stop marker	Marker menu	:MEASure:ESTOp
stop marker	Marker menu	:MEASure:TSTOp
store	Waveform Save menu (waveform)	:WMEMory:GET
store	Waveform Save menu (waveform)	:STORe
store failure	Waveform Save menu (multiple)	:MMEMory:STORe
subtract|-	Waveform Math menu	:FUNCtion:SUBTract
talk only|addressed	Utility menu (HP-IB menu)	(program language specific)
test	Define Meas menu (compare)	:MEAS:WCOMpare:WTESt
test	Define Meas menu (meas limit)	:MEASure:LIMittest
test all	Utility menu (selftest menu)	*TST
threshold	Define Meas menu (meas def)	:MEASure:DEFine
thresholds	Define Meas menu (meas def)	:MEASure:LOWer
thresholds	Define Meas menu (meas def)	:MEASure:UPPer
TIMEBASE	front-panel key	:MENU TIMebase
timebase	Waveform Save menu (waveform)	:WMEMory:XRANge
time	Utility menu (system menu)	:SYSTem:TIME

Table 4-2. Front-Panel Function to Command Cross-Reference

Front-Panel Function	Location	Command
time null	Utility menu (probe cal menu)	:CALibrate:TNULl
to	Define Meas menu (meas def)	:MEASure:DEFine
to	Define Meas menu (compare)	:MEAS:WCOMpare:COMPare
to	Display menu (seq single-shot)	:SEQuential:EXCLude
to	Display menu (seq single-shot)	:SEQuential:INCLude
TRIG	front-panel key	:MENU:TRIGger
trig'd | auto	Trigger menu	:TIMebase:MODE
trigger on	Delay Trigger menu	:TRIGger:OCCurrence
trigger on	Delay Trigger menu	:TRIGger:OCCurrence:SLOPe
trigger on	Delay Trigger menu	:TRIG:OCCurrence:SOURce
trigger on	TV Trigger menu	:TRIGger:OCCurrence
trigger on	TV Trigger menu	:TRIGger:OCCurrence:SLOPe
TTL	Channel menu	:CHANnel:TTL
tv | edge | pattern | state | delay	Trigger menu	:TRIGger:MODE
upper threshold	Define Meas menu (meas def)	:MEASure:UPPer
user defined	Define Meas menu (meas def)	:MEASure:MODE
UTIL	front-panel key	:MENU UTILity
V AMP	front-panel key	:MEASure:VAMPlitude
V AVG	front-panel key	:MEASure:VAVerage
V BASE	front-panel key	:MEASure:VBASe
V/div	Channel menu	:CHANnel:RANGe
versus | vs (WFORM MATH)	Waveform Math menu	:FUNCtion:VERSus
V marker 1	Marker menu	:MARKer:Y1Position
V marker 1	Marker menu	:MEASure:VSTArt
V marker 2	Marker menu	:MARKer:Y2Position
V marker 2	Marker menu	:MEASure:VSTOp
V MAX	front-panel key	:MEASure:VMAX
V MIN	front-panel key	:MEASure:VMIN
view failures	Waveform Save menu (multiple)	:MMEMory:FNUMber
volatile	Waveform Save menu (pixel)	:MERGe
volts | %	Define Meas menu (meas def)	:MEASure:UNITs
volts per division	Channel menu	:CHANnel:RANGe
V P-P	front-panel key	:MEASure:VPP
V RMS	front-panel key	:MEASure:VRMS
V TOP	front-panel key	:MEASure:VTOP
waveform	Waveform Save menu	:STORe
when	Delay Trigger menu	:TRIGger:LOGic
when	Glitch Trigger menu	:TRIGger:GLITch:CONDition
when	Pattern Trigger menu	:TRIGger:CONDition

Table 4-2. Front-Panel Function to Command Cross-Reference

Front-Panel Function	Location	Command
when	State Trigger menu	:TRIGger:LOGic
width	Glitch Trigger menu	:TRIGger:GLITch:WIDTh
window	Waveform Math menu (FFT)	:FUNCtion:WINDow
WFORM MATH	front-panel key	:MENU MATH
WFORM SAVE	front-panel key	:MENU SAVE
X|multiply	Waveform Math menu	:FUNCtion:MULTiply
x delta	Marker menu	:MARKer:XDELta
x delta	Marker menu	:MEASure:TDELta
x marker	Marker menu	:DISPlay:TMARker
x marker	Marker menu	:MARKer[:DISPlay]
x1 marker	Marker menu	:MARKer:X1Position
x1 marker	Marker menu	:MEASure:TSTArt
x2 marker	Marker menu	:MARKer:X2Position
x2 marker	Marker menu	:MEASure:TSTOp
y delta	Marker menu	:MARKer:YDELta
y delta	Marker menu	:MEASure:VDELta
y marker	Marker menu	:DISPlay:VMARker
y marker	Marker menu	:MARKer[:DISPlay]
y1 marker	Marker menu	:MARKer:Y1Position
y1 marker	Marker menu	:MEASure:VSTArt
y2 marker	Marker menu	:MARKer:Y2Position
y2 marker	Marker menu	:MEASure:VSTOp

The Command Tree

The command tree in figure 4-1 shows all of the commands in the HP 54505B/54506B/54510B/54512B, and the relationship of the commands to each other. The IEEE 488.2 common commands are not listed as part of the command tree since they do not affect the position of the parser within the tree. When a program message terminator (<NL>, linefeed - ASCII decimal 10) or a leading colon (:) is sent to the instrument, the parser is set to the "root" of the command tree.

Command Types

The commands for this instrument can be placed into three types:

- Common commands.
- Root level commands.
- Subsystem commands.

Common Commands

The common commands are the commands defined by IEEE 488.2. These commands control some functions that are common to all IEEE 488.2 instruments.

Common commands are independent of the tree, and do not affect the position of the parser within the tree. These commands differ from root level commands in that root level commands place the parser back at the root of the command tree.

Example:

```
*RST.
```

Root Level Commands

The root level commands control many of the basic functions of the instrument. These commands reside at the root of the command tree. Root level commands are always parsable if they occur at the beginning of a program message, or are preceded by a colon.

Example:

```
:AUTOSCALE
```

Subsystem Commands

Subsystem commands are grouped together under a common node of the command tree, such as the TIMEBASE commands. Only one subsystem may be selected at any given time. When the instrument is initially turned on, the command parser is set to the root of the command tree, therefore, no subsystem is selected.

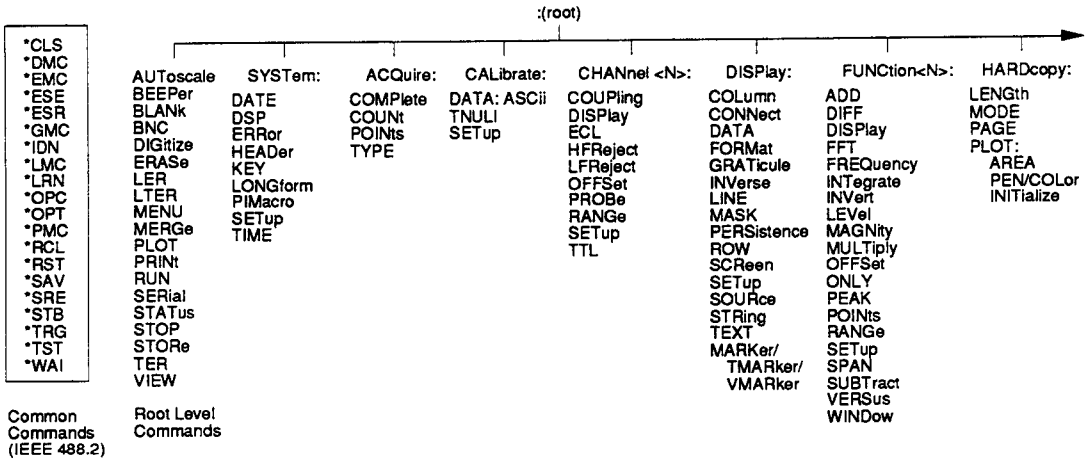

Figure 4-1. HP54505B/54506B/54510B/54512B Command Tree

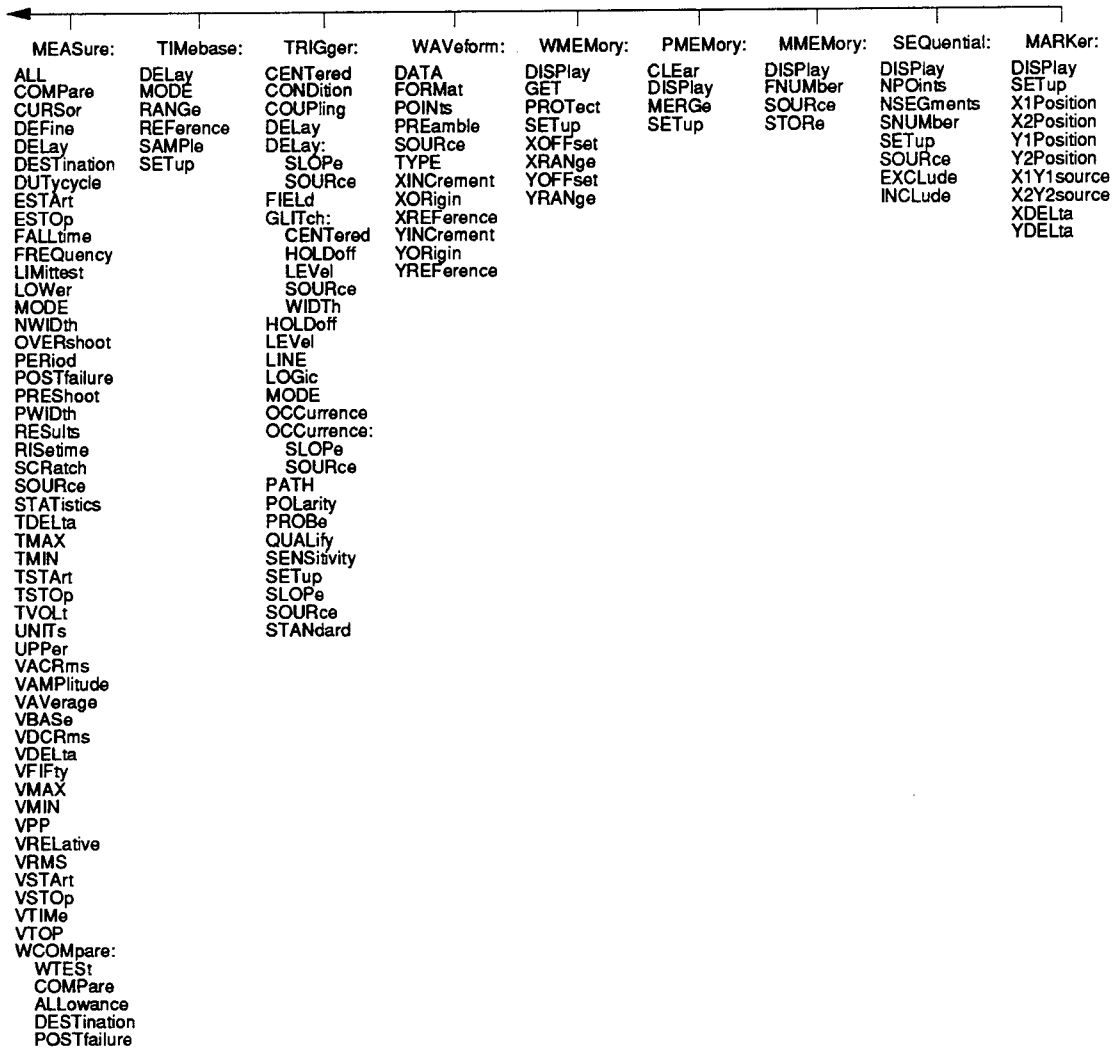

Figure 4-1.HP54505B/54506B/54510B/54512B Command Tree (cont)

Tree Traversal Rules

Command headers are created by traversing down the command tree. A legal command header from the command tree in figure 4-1 would be :CHANNEL1:RANGE. This is referred to as a compound header. A compound header is a header made of two or more mnemonics separated by colons. The mnemonic created contains no spaces. The following rules apply to traversing the tree:

- A leading colon or a < program message terminator > (either an < NL > or EOI true on the last byte) places the parser at the root of the command tree. A leading colon is a colon that is the first character of a program header.
- Executing a subsystem command places you in that subsystem until a leading colon or a < program message terminator > is found. In the Command Tree, figure 4-1, use the last mnemonic in the compound header as a reference point (for example, RANGE). Then find the last colon above that mnemonic (CHANNEL< N >:). That is the point where the parser resides. Any command below that point can be sent within the current program message without sending the mnemonics which appear above them (for example, OFFSET).

Examples

The OUTPUT statements in the examples are written using HP BASIC 5.0 on a HP 9000 Series 200/300 Controller. The quoted string is placed on the bus, followed by a carriage return and linefeed (CRLF).

Example 1:

```
OUTPUT 707;":CHANNEL1:RANGE 0.5 ;OFFSET 0"
```

Comments:

The colon between CHANNEL1 and RANGE is necessary because CHANNEL1:RANGE is a compound command. The semicolon between the RANGE command and the OFFSET command is the required program message unit separator. The OFFSET command does not need CHANNEL1 preceding it, since the CHANNEL1:RANGE command sets the parser to the CHANNEL1 node in the tree.

Example 2:

```
OUTPUT 707;":TIMEBASE:REFERENCE CENTER;DELAY 0.00001"
```

or

```
OUTPUT 707;":TIMEBASE:REFERENCE CENTER"
OUTPUT 707;":TIMEBASE:DELAY 0.00001"
```

Comments:

In the first line of example 2, the "subsystem selector" is implied for the DELAY command in the compound command. The DELAY command must be in the same program message as the REFERENCE command, since the program message terminator places the parser back at the root of the command tree.

A second way to send these commands is by placing TIMEBASE: before the DELAY command as shown in the second part of example 2.

Example 3:

```
OUTPUT 707;":TIMEBASE:REFERENCE CENTER;:CHANNEL1:OFFSET 0"
```

Comments:

The leading colon before CHANNEL1 tells the parser to go back to the root of the command tree. The parser can then see the CHANNEL1:OFFSET command.

Infinity Representation

The representation of infinity is 9.99999E+37. This is also the value returned when a measurement cannot be made.

Sequential and Overlapped Commands

IEEE 488.2 makes the distinction between sequential and overlapped commands. Sequential commands finish their task before the execution of the next command starts. Overlapped commands run concurrently. Commands following an overlapped command may be started before the overlapped command is completed. All of the commands of the oscilloscope are sequential.

Response Generation

As defined by IEEE 488.2, query responses may be buffered for the following conditions:

- When the query is parsed by the instrument.
- When the controller addresses the instrument to talk so that it may read the response.

The oscilloscope buffers responses to a query when the query is parsed.

Notation Conventions and Definitions

The following conventions and definitions are used in this manual in descriptions of remote HP-IB operation:

Conventions

< > Angle brackets enclose words or characters that symbolize a program code parameter or an HP-IB command.

::= "is defined as." For example, <A> ::= <B> indicates that <A> can be replaced by <B> in any statement containing <A>.

| "or." Indicates a choice of one element from a list. For example, <A> | <B> indicates <A> or <B>, but not both.

... An ellipsis (trailing dots) indicates that the preceding element may be repeated one or more times.

[ ] Square brackets indicate that the enclosed items are optional.

{ } When several items are enclosed by braces, one, and only one of these elements must be selected.

Definitions

d ::= A single ASCII numeric character, 0-9.

n ::= A single ASCII non-zero, numeric character, 1-9.

<NL> ::= Newline or Linefeed (ASCII decimal 10).

<sp> ::= <white space>

<white space> ::= 0 through 32 (decimal) except linefeed (decimal 10).

Syntax Diagrams

Chapters 6 through 23 contain syntax diagrams showing the proper syntax for each command. All characters contained in a circle or oblong are literals, and must be entered exactly as shown. Words and phrases contained in rectangles are names of items used with the command and are described in the accompanying text of each command. Each line can only be entered from one direction as indicated by the arrow on the entry line. Any combination of commands and arguments that can be generated by following the lines in the proper direction is syntactically correct. An argument is optional if there is a path around it. Where there is a rectangle which contains the word "space," a white space character must be entered. White space is optional in many other places.

Program Examples

The program examples given for each command in chapters 6 through 23 were written on an HP 9000 Series 200/300 controller using the HP BASIC 5.0 programming language. The programs always assume the oscilloscope is at address 707. If a printer is used, it is always assumed to be at address 701.

In these examples, pay special attention to the ways in which the command or query can be sent. The way the instrument is set up to respond to a command or query has no bearing on how you send the command or query. That is, the command or query can be sent using the long form or short form, if a short form exists for that command. You can send the command or query using upper case (capital) letters or lower case (small) letters. Also, the data can be sent using almost any form you wish. If you are sending a channel 1 range value of 100 mV, that value could be sent using a decimal (.1), or an exponential (1e-1 or 1.0E-1), or a suffix (100 mV or 100MV).

As an example, set channel 1 range to 100 mV by sending one of the following:

- Commands in long form using the decimal format.

```
OUTPUT 707;":CHANNEL1:RANGE .1"
```

- Commands in short form using an exponential format.

```
OUTPUT 707;":CHAN1:RANG 1E-1"
```

- Commands using lower case letters, short forms, and a suffix.

```
OUTPUT 707;":chan1:rang 100 mV"
```

Note In these examples, the colon as the first character of the command is optional. The space between RANGE and the argument is required.

If you want to observe the headers for the queries, you must bring the returned data into a string variable. Generally, you should dimension all string variables before reading the data.

If you do not need to see the headers and a numeric value is returned from the oscilloscope, then you should use a numeric variable. In this case the headers should be turned off.

Command Set Organization

The command set for the oscilloscope is divided into common commands, root level commands and 16 sets of subsystem commands. Each of the 18 groups of commands is described in the following chapters. Each of the chapters contain a brief description of the subsystem, a set of syntax diagrams for the commands, and the commands for each subsystem in alphabetic order.

The commands are shown in the long form and short form using upper and lowercase letters. As an example, AUToscale indicates that the long form of the command is AUTOSCALE and the short form of the command is AUT. Each command listing contains a description of the command and its arguments, the command syntax, and a programming example.

The sixteen subsystems in the HP 54505B, HP 54506B, HP 54510B, and HP 54512B are listed below:

SYSTem - controls some basic functions of the oscilloscope.

ACQuire - sets the parameters for acquiring and storing data.

CALibrate - sets the time nulls (channel-to-channel skew) and returns the instrument's calibration data.

CHANnel - controls all Y-axis oscilloscope functions.

DISPlay - controls how waveforms, voltage and time markers, graticule, and text are displayed and written on the screen.

FUNCtion - controls the waveform math functions of the oscilloscope.

HARDcopy - controls the parameters used during the plotting or printing of waveforms.

MEASure - selects the automatic measurements to be made.

TIMebase - controls all X-axis oscilloscope functions.

TRIGger - controls the trigger modes and parameters for each trigger mode.

WAVeform - provides access to waveform data, including active data from channels and functions as well as static data from waveform memories.

WMEMory - controls waveform memory functions.

PMEMory - controls pixel memory functions.

MMEMory - controls multiple memory functions.

SEQuential - controls sequential memory mode configuration and display parameters.

MARKer - controls x- and y-marker functions.

Table 4-3 lists the commands for the oscilloscope in alphabetical order with their corresponding subsystem or command type.

Table 4-3. Alphabetic Command Cross-Reference

Command	Where Used
ADD	FUNCtion Subsystem
ALL	MEASure Subsystem
AUToscale	Root Level Command
BEEPer	Root Level Command
BLANk	Root Level Command
BNC	Root Level Command
CENTered	TRIGger Subsystem
CLEar	PMEMory Subsystem
*CLS	Common Command
COLumn	DISPlay Subsystem
COMPare	MEASure Subsystem
COMPlete	ACQuire Subsystem
CONDition	TRIGger Subsystem
CONNect	DISPlay Subsystem
COUNt	ACQuire Subsystem
COUPling	CHANnel Subsystem
COUPling	TRIGger Subsystem
CURSor	MEASure Subsystem
DATA	DISPlay Subsystem
DATA	WAVeform Subsystem
DATA:ASCii	CALibrate Subsystem
DATE	SYSTem Sunsystem
DEFine	MEASure Subsystem
DELay	MEASure Subsystem
DELay	TIMebase Subsystem
DELay	TRIGger Subsystem
DELay:SLOPe	TRIGger Subsystem
DELay:SOURce	TRIGger Subsystem
DESTination	MEASure Subsystem
DIFF	FUNCtion Subsystem
DIGitize	Root Level Command
[DISPlay]	CHANnel Subsystem
[DISPlay]	FUNCtion Subsystem
[DISPlay]	MARKer Subsystem
[DISPlay]	MMEMory Subsystem
[DISPlay]	PMEMory Subsystem
[DISPlay]	SEQuential Subsystem
[DISPlay]	WMEMory Subsystem
*DMC	Common Command
DSP	SYSTem Subsystem

Table 4-3. Alphabetic Command Cross-Reference

Command	Where Used
DUTycycle	MEASure Subsystem
ECL	CHANnel Subsystem
ERASe	Root Level Command
ERRor	SYSTem Subsystem
*EMC	Common Command
*ESE	Common Command
*ESR	Common Command
ESTArt	MEASure Subsystem
ESTOp	MEASure Subsystem
EXCLude	SEQuential Subsystem
FALLtime	MEASure Subsystem
FFT	FUNCtion Subsystem
FIELd	TRIGger Subsystem
FNUMber	MMEMory
FORMat	DISPlay Subsystem
FORMat	WAVeform Subsystem
FREQuency	FUNCtion Subsystem
FREQuency	MEASure Subsystem
GET	WMEMory Subsystem
GLITch	TRIGger Subsystem
GLITch:CENTered	TRIGger Subsystem
GLITch:HOLDoff	TRIGger Subsystem
GLITch:LEVel	TRIGger Subsystem
GLITch:SOURce	TRIGger Subsystem
GLITch:WIDTh	TRIGger Subsystem
*GMC	Common Command
GRATicule	DISPlay Subsystem
HEADer	SYSTem Subsystem
HFReject	CHANnel Subsystem
HOLDoff	TRIGger Subsystem
*IDN	Common Command
INCLude	SEQuential Subsystem
INTegrate	FUNCtion Subsystem
INVerse	DISPlay Subsystem
INVert	FUNCtion Subsystem
KEY	SYSTem Subsystem
LENGth	HARDcopy Subsystem
LER	Root Level Command
LEVel	FUNCtion Subsystem
LEVel	TRIGger Subsystem

Table 4-3. Alphabetic Command Cross-Reference

Command	Where Used
LFReject	CHANnel Subsystem
LIMittest	MEASure Subsystem
LINE	DISPlay Subsystem
LINE	TRIGger Subsystem
*LMC	Common Command
LOGic	TRIGger Subsystem
LONGform	SYSTem Subsystem
LOWer	MEASure Subsystem
*LRN	Common Command
LTER	Root Level Command
MAGNify	FUNCtion Subsystem
MASK	DISPlay Subsystem
MENU	Root Level Command
MERGe	PMEMory Subsystem
MERGe	Root Level Command
MODE	HARDcopy Subsystem
MODE	MEASure Subsystem
MODE	TIMebase Subsystem
MODE	TRIGger Subsystem
MULTiply	FUNCtion Subsystem
NPOints	SEQuential Subsystem
NSEGments	SEQuential Subsystem
NWIDth	MEASure Subsystem
OCCurrence	TRIGger Subsystem
OCCurrence:SLOPe	TRIGger Subsystem
OCCurrence:SOURce	TRIGger Subsystem
OFFSet	CHANnel Subsystem
OFFSet	FUNCtion Subsystem
ONLY	FUNCtion Subsystem
*OPC	Common Command
*OPT	Common Command
OVERshoot	MEASure Subsystem
PAGE	HARDcopy Subsystem
PATH	TRIGger Subsystem
PEAK	FUNCtion Subsystem
PERiod	MEASure Subsystem
PERSistence	DISPlay Subsystem
PIMacro	SYSTem Subsystem
PLOT	Root Level Command
PLOT:AREA	HARDcopy Subsystem

Table 4-3. Alphabetic Command Cross-Reference

Command	Where Used
PLOT:COLor	HARDcopy Subsystem
PLOT:INITialize	HARDcopy Subsystem
PLOT:PEN|COLor	HARDcopy Subsystem
*PMC	Common Commands
POINts	ACQuire Subsystem
POINts	FUNCtion Subsystem
POINts	WAVeform Subsystem
POLarity	TRIGger Subsystem
POSTfailure	MEASure Subsystem
PREamble	WAVeform Subsystem
PREShoot	MEASure Subsystem
PRINt	Root Level Command
PROBe	CHANnel Subsystem
PROBe	TRIGger Subsystem
PROTect	MEMory Subsystem
PWIDth	MEASure Subsystem
QUALify	TRIGger Subsystem
RANGe	CHANnel Subsystem
RANGe	FUNCtion Subsystem
RANGe	TIMebase Subsystem
*RCL	Common Command
REFerence	TIMebase Subsystem
RESults	MEASure Subsystem
RISetime	MEASure Subsystem
ROW	DISPlay Subsystem
*RST	Common Command
RUN	Root Level Command
SAMPle	TIMebase Subsystem
*SAV	Common Command
SCRatch	MEASure Subsystem
SCReen	DISPlay Subsystem
SENSitivity	TRIGger Subsystem
SERial	Root Level Command
SETup	CALibrate Subsystem
SETup	CHANnel Subsystem
SETup	DISPlay Subsystem
SETup	FUNCtion Subsystem
SETup	MARKer Subsystem
SETup	PMEMory Subsystem
SETup	SEQuential Subsystem

Table 4-3. Alphabetic Command Cross-Reference

Command	Where Used
SETup	SYSTem Subsystem
SETup	TIMebase Subsystem
SETup	TRIGger Subsystem
SETup	WMEMory Subsystem
SLOPe	TRIGger Subsystem
SPAN	FUNCtion Subsystem
SNUMber	SEQuential Subsystem
SOURce	DISPlay Subsystem
SOURce	MEASure Subsystem
SOURce	MMEMory Subsystem
SOURce	SEQuential Subsystem
SOURce	TRIGger Subsystem
SOURce	WAVeform Subsystem
*SRE	Common Command
STANdard	TRIGger Subsystem
STATistics	MEASure Subsystem
STATus	Root Level Command
*STB	Common Command
STOP	Root Level Command
STORe	MMEMory Subsystem
STORe	Root Level Command
STRing	DISPlay Subsystem
SUBTract	FUNCtion Subsystem
TDELta	MEASure Subsystem
TER	Root Level Command
TEXT	DISPlay Subsystem
TIME	SYSTem Subsystem
TMARker	DISPlay Subsystem
TMAX	MEASure Subsystem
TMIN	MEASure Subsystem
TNULl	CALibrate Subsystem
*TRG	Common Command
*TST	Common Command
TSTArt	MEASure Subsystem
TSTOp	MEASure Subsystem
TTL	CHANnel Subsystem
TVOLt	MEASure Subsystem
TYPE	ACQuire Subsystem
TYPE	WAVeform Subsystem
UNITs	MEASure Subsystem

Table 4-3. Alphabetic Command Cross-Reference

Command	Where Used
UPPer	MEASure Subsystem
VACRms	MEASure Subsystem
VAMPlitude	MEASure Subsystem
VAVerage	MEASure Subsystem
VBASe	MEASure Subsystem
VDCRms	MEASure Subsystem
VDELta	MEASure Subsystem
VERSus	FUNCtion Subsystem
VFIFty	MEASure Subsystem
VIEW	Root Level Command
VMARker	DISPlay Subsystem
VMAX	MEASure Subsystem
VMIN	MEASure Subsystem
VPP	MEASure Subsystem
VRELative	MEASure Subsystem
VRMS	MEASure Subsystem
VSTArt	MEASure Subsystem
VSTOp	MEASure Subsystem
VTIMe	MEASure Subsystem
VTOP	MEASure Subsystem
*WAI	Common Command
WCOMpare	MEASure Subsystem
WCOMpare:WTESt	MEASure Subsystem
WCOMpare:COMPare	MEASure Subsystem
WCOMpare:ALLowance	MEASure Subsystem
WCOMpare:DESTination	MEASure Subsystem
WCOMpare:POSTfailure	MEASure Subsystem
WINDow	FUNCtion Subsystem
XDELta	MARKer Subsystem
XINCrement	WAVeform Subsystem
XOFFset	WMEMory Subsystem
XORigin	WAVeform Subsystem
XRANge	WMEMory Subsystem
XREFerence	WAVeform Subsystem
X1Position	MARKer Subsystem
X1Y1source	MARKer Subsystem
X2Position	MARKer Subsystem
X2Y2source	MARKer Subsystem
YDELta	MARKer Subsystem
YINCrement	WAVeform Subsystem

Table 4-3. Alphabetic Command Cross-Reference

Command	Where Used
YOFFset	WMEMory Subsystem
YORigin	WAVeform Subsystem
YRANge	WMEMory Subsystem
YREFerence	WAVeform Subsystem
Y1Position	MARKer Subsystem
Y2Position	MARKer Subsystem
YREFerence	WAVeform Subsystem