Protek C3100

Programmable 2.4GHz Universal Counter

FUN:FRQ.A   G.T:50mS
TRIG:+50mV 1 AC X10

2.4000000GHz
0.4166666nS

REF:2.3400000GHz
ERR:+2.56%

Protek
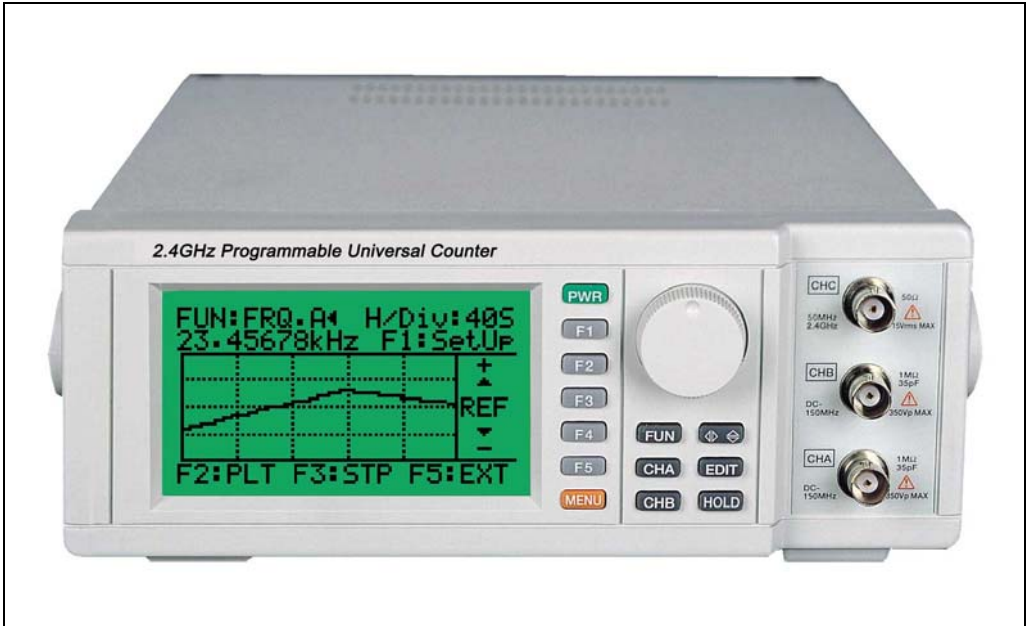
Programmable Universal Counter

Safety rules to using his device

Safety Regulations

1. Do not touch any part of high voltage circuit or make any unnecessary measurements. Do not remove the top or bottom covers of this unit unless you are a qualified service person. Remove the power from this unit before removing the top and bottom covers.

2. When servicing this unit, the work area should be free from any electrical hazards. The floor and workbench where the unit is operated should be insulated and free from any exposed high voltage conductors. Remove any source of water or other conductive liquids in the working area.

3. Connect this unit only to a 3-prong AC outlet, which conforms to electrical safety, codes. Do not use any adapters to connect this unit to an AC receptacle.

4. Before operating or servicing, this instrument, read the instruction manual and fully understand the operating procedures. If you are servicing the unit, check the circuit you are testing for high voltage.

5. Do not use this device in a room alone, be sure there are other people in the vicinity of your work area in case of an emergency arises. Have emergency telephone numbers posted in the work area in case a quick response is necessary.

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Chapter 1. General specification

1. Product summary

This programmable frequency counter is one of a series of programmable test instruments that has enhanced features over similar type of test instruments on the market today. This instrument features:

1) High accuracy frequency measurement to 2.4 GHz.
2) Nine measurement functions: FRQ. A, FRQ. B, FRQ. C, Time interval, Totalize, Ratio A/B, Difference freq. (A-B), Duty cycle and RPM.
3) Plots a Trend Graph on the LCD.
4) Compare, Relative, Error and MIN/MAX functions.
5) Setting and functions may be selected and stored in memory from the front panel. Eight setup pages may be stored.
6) Function and ranges may be controlled from a PC via the RS232 or the optional GP-IB interface.
7) May be used with any line voltages from 85V to 270V AC with out any internal changes.
8) Have many applications in research and development, service, production line, the satellite broadcasting and telecommunications industries.

2. General specifications

1) AC line and fuse rating:

Rated voltage	Fuse	Power consumption (max)
85V to 270Vac(±10%, 48 to 66Hz)	2A/250V	15W

2) Operational Temperature:
   0°C to +40°C (+32°F to +104°F) at a relative humidity 85% or less

3) Storage Temperature:
   -20°C to +70°C (-4°F to +158°F) with a relative humidity of 85% or less

4) Dimensions:
   235mm (width) x   296mm (depth) x   85 mm (height)
   9.25" (width) x   11.65" (depth) x   3.34" (height)

5) Weight: about 1.5 kg (4.4lbs)

3. Electrical Specifications
Note: Electrical specifications are at 25°C.

1) **CHA**, **CHB** input characteristics
  ・ Freq. Range :0 to 120Mhz(DC Coupled)
                   10Hz to 120MHz(AC coupled)
  ・ Sensitivity: 25mV rms (Sine Wave)
  ・ Impedance : 1Mohm less with less than 35pF capacitance
  ・ Attenuator: x1, x10
  ・ Maximum input voltage : 250V (DC or AC Peak)
  ・ Trigger level: ±1.28V variable.
   (The trigger level is displayed as a scale −99 to +99 units)
  ・ Trigger slope: (+) or (-) (Positive or Negative)

2) **CHC** input characteristics: (FREQ. C)
  ・ Freq. Range: 100MHz to 2.4GHz
  ・ Sensitivity: 25mV rms (Sine Wave)
  ・ Coupling: AC
  ・ Maximum input voltage: 5V (DC or AC peak)

3) GATE TIMES:
  ・ 50mS, 100mS, 200mS, 300mS, 400mS, 500mS, 600mS, 700mS, 800mS,
   900mS, 1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S
  ・ Gating Accuracy Time base accuracy: 1ppm

4) Functions:
  (1) FRQ. A and FRQ. B
    ▫ Frequency range: 0 to 120Mhz(DC Coupled)
                   10Hz to 120MHz(AC coupled)
    ▫ Coupling: AC or DC
    ▫ Slope: Positive or Negative
    ▫ Trigger level: ±1.28V variable
        (The trigger level is displayed as a scale −99 to +99 units)
    ▫ Low Pass filter: Approximately 100kHz
    ▫ Attenuation: 0 and 20dB (x1 and x10)
    ▫ Resolution: 0.00001Hz (Gate time = 1Sec, Input Frq = 200Hz)
    ▫ Accuracy: ±Time Base Error ±1 Count

  (2) FRQ.C
    ▫ Frequency Range: 100MHz to 2.4GHz
    ▫ Slope: Positive or Negative
    ▫ Trigger level: Auto

▫ Coupling: AC
▫ Accuracy: ±Time Base Error ±1 Count

(3) Time Interval (A➜B)
  ▫ Input: Channel A and B
  ▫ Measurement range: 0.5uS to 0.2S (5Hz to 2MHz)
  ▫ Pulse width: 250nS minimum
  ▫ Resolution: 0.1uS Max
  ▫ Accuracy: Time Base Error ± CHA Trigger Error ± Magnification

        ±1 Count

(4) TOT. A (Totalize)
  ▫ Input: Channel A
  ▫ Measurement range: DC to 10MHz
  ▫ Count Capacity: 0 to 9,999,999(Over Flow)
  ▫ Hold button controls the Start and Stop

(5) Ratio A/B
  ▫ Input: Channel A and B
  ▫ Measurement range:
     CHA input: 10MHz to120MHz
     CHB input: 0.1MHz to 10MHz
  ▫ Accuracy: CHB Trigger Error/(CHB Freq. x Gate Time) ±1 Count

(6) A-B Freq. Difference
  ▫ Input: Channel A and B
  ▫ Frequency Range: Same as CHA and CHB
  ▫ Accuracy: Time Base Error ±1 Count

(7) DTY. A (Duty Cycle)
  ▫ Input: Channel A
  ▫ Duty cycles from 0.1% to 99% may be measured.

(8) RPM A measure
  ▫ Input: Channel A
  ▫ Maximum RPM: 600,000 RPM
  ▫ Minimum pulse width: 250nS

(9) Reference Time Base Oscillator
  ▫ Standard Frequency: 10MHz, 4.194304MHz
  ▫ Frequency Stability: ±5.0ppm max.
  ▫ Aging Rate: ±1.0ppm max./year
  ▫ Temperature: -30°C to +60°C
  ▫ Storage Temp. Range: -40°C to +85°C

4. Accessories

This unit is shipped with the following accessories:

1) Manual·· 1 copy
2) BNC cable ··· 1 unit
3) Line Cord··· 1 unit
4) Spare fuse (2A, 250V) ······································· 1 unit
5) RS232 Cable (9Pin to 9Pin) ······························ 1 unit
6) RS232 Program·· 1 unit

Note:
The accessories may be changed to improve the product quality without notifying the customers. Optional accessories will be made available at a later date.

Chapter 2. Installation of the equipment

This chapter supplies all the necessary information to install this equipment.
It includes: initial inspection, preparation for use, appropriate voltage selection, packing for the return, etc.

1. Initial inspection

1) When received, inspect the shipping box for damage. If the shipping carton is damaged verify that there is no mechanical damage to the instrument and it is functional. Verify that all accessories are present.
2) Save the shipping carton and packing material until the unit is verified functional and within specification.
3) If the unit is not functional or accessories are missing, report all problems to the vendor where the unit was purchased as soon as possible to arrange for repair or replacement.
4) Report any shipping damaged to the shipping carrier's agent.

2. Preparation for use

1) Before tuning the unit on verify that the AC line is within 85V to 270Vac(±10%), at a line frequency of 48 to 66Hz.
2) Check to see if the fuse has the correct rating. (2A / 250V)
3) Make sure the unit is connected properly and is being used within the specifications listed above.

3. Environmental

1) This equipment should be operated in a well-ventilated area, with in a temperature range of 0 to +40°C (+32°F to 104°F) and a relative humidity 85% or less and stored in a dry place within temperature range between -20°C to +70°C (-4°F to +158°F) with a relative humidity 85% less.

Chapter 3. Product description

In this chapter, the front and rear panel buttons, controls and connectors are described.

1. Front Panel buttons and connectors description
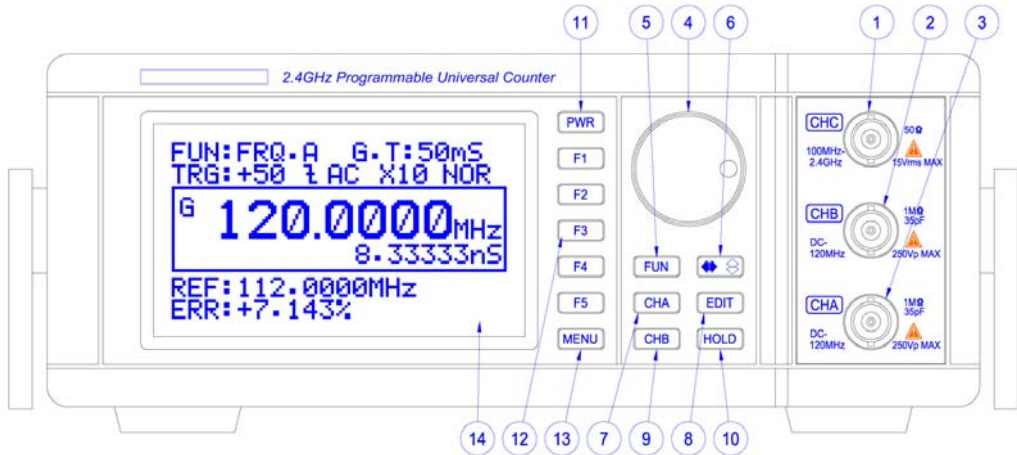
[Figure 1] Front Panel

1) **CHC** input BNC
   Input for measuring frequencies from 100MHz to 2.4GHz.

2) **CHB** input BNC
   Input for measuring frequencies from 0 to 120MHz and is used along with **CHA** for measuring Time interval (**A➔B**), Ratio (**A/B**) and Difference frequency (**A-B**).

3) **CHA** BNC
   Input for measuring frequencies from 0 to 120MHz, Duty Cycle and RPM. It is also used along with **CHB** for measuring Time interval (**A➔B**), Ratio (**A/B**) and Difference frequency (**A-B**).

4) Rotary dial
   The rotary dial when turned changes the cursor position on the LCD and selects functions, setup values and is used for editing frequency values in the Compare and Relative modes

5) [**FUN**] Button
   Displays on the LCD the list of measurement functions and their corresponding F button for selection (See **Table 1**). Press the MENU button to return to the normal display.

| FRQ.A   F1 | | Prev ▲   F1 | | Prev ▲   F1 |

FRQ.B	F2			TOT.A	F2		
FRQ.C	F3	Press		A/B	F3	Press	
A→B	F4	F5 Button		A-B	F4	F5 Button	
More ▼	F5	⇒		More ▼	F5	⇒	

DTY.A	F2
RPM A	F3
	F4
EXIT	F5

[Table 1] Fun Button layout

6) ◆ ⇳ Button

Toggles the cursor between the selection mode cursor displayed as a (**<** or **>**) symbol and the edit mode cursor displayed as a (◄ or ►) symbol when changing counter settings and functions.

It also toggles the cursor between the digit selection cursor, which is displayed as a (◄►) symbol, and the digits edit cursor displayed as a (⬍) symbol when changing Relative frequency or Hi/LO limit values in the Relative or compare mode.

7) [**CHA**] Button

Displays the current CHA settings along with a corresponding F button on the LCD as shown in **Table 2**. Pressing the F button changes the current setting to the alternate menu setting.

Pressing the CHA button again returns the display to the normal screen.

	CHA	F1	Menu selections
⌐	Slope	F2	Positive or negative slope
AC	DC/AC	F3	SC or AC coupling
X1	Attenuation	F4	X1 or X10
Nor	Nor	F5	Low Pass Filter or normal

[Table 2] CHA Button Layout

8) [**EDIT**] Button

Displays the cursor in the setup or Equipment menus for editing counter settings or data values. The cursor will be displayed in the bottom section of the LCD when REL (relative) or Comp (comparison) mode is selected. The cursor indicates the Reference frequency value in the relative (REL) mode and the HI/LO limit values in the comparison (COMP) mode.

Pressing the EDIT button a second time will cause the cursor to disappear.

9) [**CHB**] Button:

Displays the current CHB settings along with a corresponding F button on the LCD as shown in **Table 2**. Pressing the F button changes the current setting to the alternate menu value.

Pressing the CHB button again will returns the display to the normal screen.

10) [**HOLD**] Button

Freezes the displayed LCD value and displays an H on the LCD. It is also used to stop and start the count in the Totalize mode.
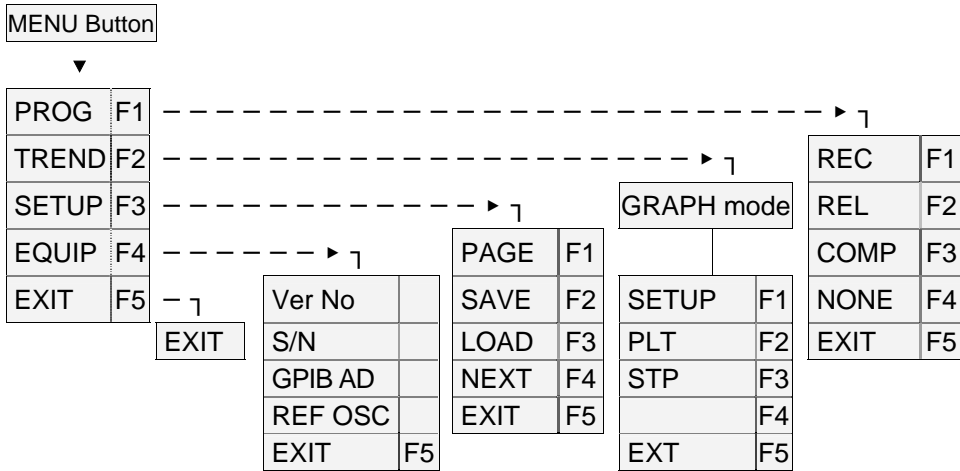
11) [**PWR**] Button

Pressing this button for 1.5 to 2 second will turn the unit on. Pressing this button again for 1.5 to 2 seconds will turn the power off.

12) [**F1, F2, F3, F4, F5**] Buttons
These buttons have a corresponding menu item displayed on the LCD when the MENU, CHA, CHB or FUN, buttons are pressed. Pressing the F button selects the desired item. (See **Table 1** and **2**)

13) [**MENU**] Button
Displays the MENU and submenus as shown in **Figure 2**. The menu is explained in detail in a later chapter.

MENU Button							
PROG	F1					REC	F1
TREND	F2					REL	F2
SETUP	F3			GRAPH mode		COMP	F3
EQUIP	F4		PAGE	F1		NONE	F4
EXIT	F5	Ver No	SAVE	F2	SETUP	F1	EXIT	F5
	EXIT	S/N	LOAD	F3	PLT	F2	
		GPIB AD	NEXT	F4	STP	F3	
		REF OSC	EXIT	F5		F4	
		EXIT	F5		EXT	F5	

[Figure 2] Menu Layout

14) LCD
Displays the measurement data, menu, etc. See **Figure 5**.

2. Rear Panel
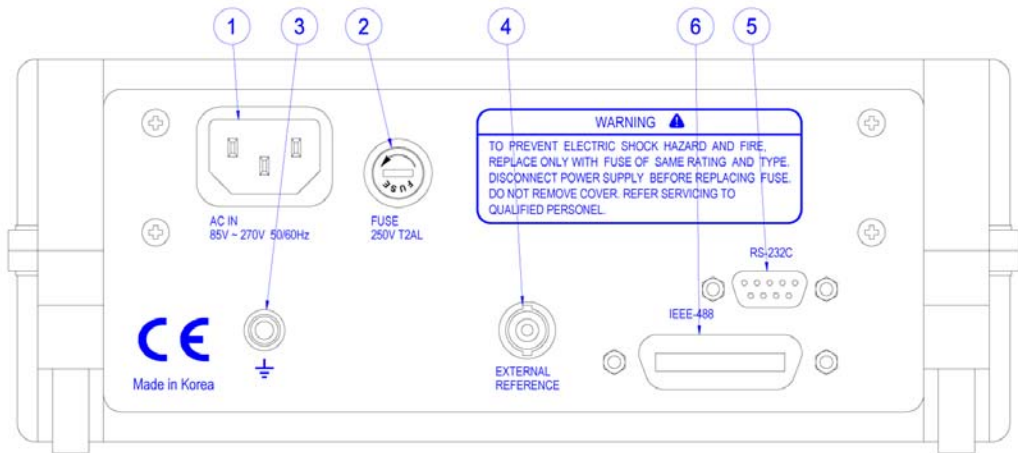
[Figure 3] Rear Panel

CAUTION

Before using, check that the AC line voltage is within the specified line voltage range.

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1) AC input
The AC line cord is inserted in to this connector. The allowable AC voltage range is 85V to 270Vac (±10%), 48 to 66 Hz.

2) Fuse Holder
Holds the 2amp 250-volt fuse.

CAUTION

Remove the AC line power when changing this fuse.

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3) GND TERMINAL
Chassis ground terminal

4) External Reference frequency input terminal
An external 10MHz reference frequency source may be connected to this input for greater time base accuracy.

5) RS232 PORT
A 9pin DIN connector for connecting an RS-232 cable from the instrument to the PC. This is used along with the software for controlling the instrument from a PC.

6) GP-IB port [Option]

Standard IEEE-488 connector for connecting multiple devices to the GP-IB interface.

* Note
The total cable length should be less than 25m(80ft) and the maximum number of device connections (including controller) is 15.

◈ **GP-IB Example**
Figure 4 is an example of connecting multiple devices to the GP-IB port.
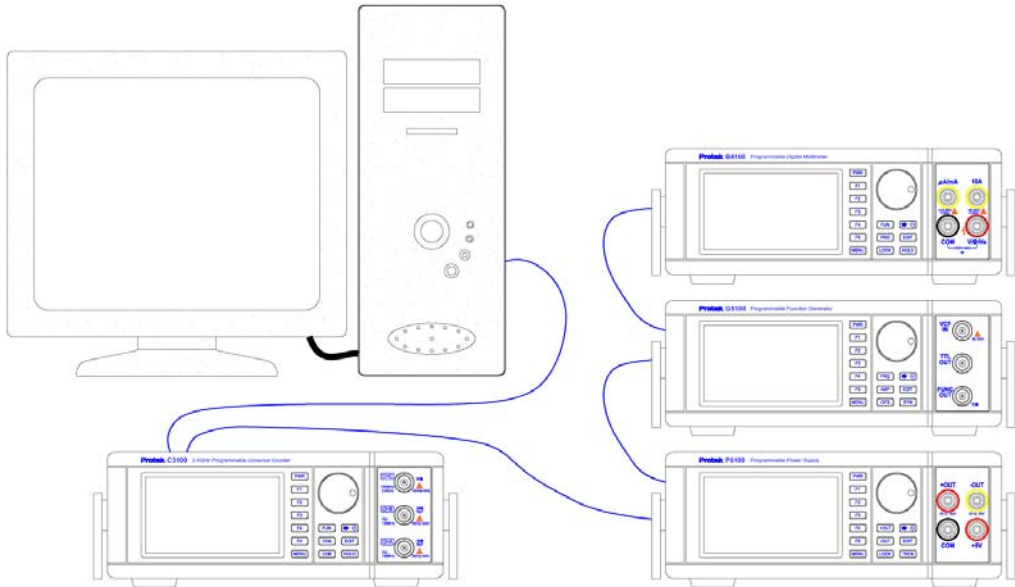
[Figure 4] GP-IB (Example of connecting the connector)

# Chapter 4. LCD, Front panel buttons and menus description

1. LCD display description

Section 1-TOP DISPLAY	← Displays The current setup values and the selection/edit cursor
Section 2-MAIN-DISPLAY	← Displays The measured values or Pass/ fail when in the compare mode
Section 3-BOTTOM-DISPLAY	← Displays: • MAX, MAX, when in REC, • REF and % error when in REL • HI/LO limits when in COMP • B Channel settings when in Ratio and Time interval • Selection/Edit cursor when the **EDIT** button is pressed

[Table 3] LCD display areas
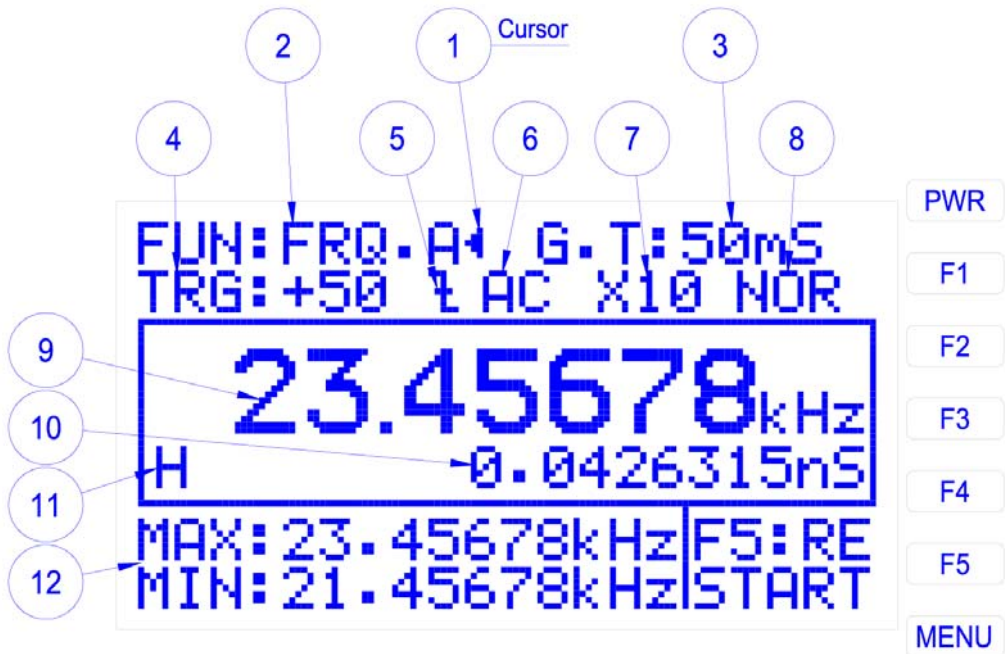
[Figure 5] LCD Display

1) Cursor

    (1) The cursor is displayed in the upper part of the LCD when the unit is first turned on as shown in **Figure 5**. It is used to indicate and change counter settings and functions. When the cursor is displayed as a (**<** or **>**) symbol it is the selection cursor and can be moved from one menu item to another by turning the rotary dial. When the cursor appears as a (◄ or ►) it is the edit cursor and is used to change the setting it is indicating by turning the rotary dial.

    (2) The cursor is also displayed in the setup menu or the bottom of the LCD in the REL or COMP program modes when the EDIT button is pressed. The cursor can be used to change settings as explained in the above paragraph or the numerical values in the REL or COMP program modes.

    (3) When a numerical value is to be changed, indicate it with the selection cursor (< or >), then press the ⬥⬖ Button to display the edit cursor (◄ or ►). Rotating the rotary dial changes the cursor to a (◄►) symbol and highlights a digit. Turning the rotary dial further moves the highlight to the next consecutive digit. Pressing the ⬥⬖ Button changes the cursor to the Digit edit cursor displayed as a (⬦) symbol. Turning the rotary dial clockwise increases the digit value; counter clockwise decreases the digit value.

2) FUN (Function)

    ▫ Displays the currently selected function.

    ▫ FRQ.A, FRQ.B, FRQ.C, Time interval (**A➔B**), TOT.A ,Ratio(**A/B**) , Difference frequency (**A-B**), DTY.A, or RPM A may be selected and displayed

    (1) To change the function, press the FUN button then press the corresponding F button for the new function.

3) G.T (Gate Time)

    ▫ Displays the current Gate Time.

    ▫ The gate times that can be selected are: 50mS, 100mS, 200mS, 300mS, 400mS, 500mS, 600mS, 700mS, 800mS, 900mS, 1S, 2S, 3S, 4S, 5S, 6S, 7S, 8S, 9S, 10S.

    ▫ To change the G.T value.

    (1) Press the ⬥⬖ Button to display the selection mode cursor (< or >).

    (2) Turn the rotary dial until the cursor indicates "G.T: ____"

    (3) Press the ⬥⬖ button to change the cursor to the edit mode (◄ or ►).

    (4) Rotate the rotary dial to display the new gate time

4) TRG: (Trigger Level)

- ▫ Displays the current Trigger level value.

- ▫ The range of the TRIG LEVEL is : ±1.28V as a scale from -99 to +99 units

- ▫ To change the current TRIG level: press ⬦⊕ Button to display the selection mode cursor (< or >). Turn the rotary dial to indicate TRG and perform steps 3 and 4 in 3], changing the gate time.

5) ⌐, ⌐ (Trigger SLOPE)

- ▫ Displays the current Trigger SLOPE .

- ▫ SLOPE directions : Positive and Negative.

- ▫ To change the Trigger SLOPE, press the CHA or CHB button and then the [**F2**] button (see page 7 Table 2).

6) DC/AC (COUPLING)

- ▫ Displays the current COUPLING.

- ▫ COUPLING types : DC or AC.

- ▫ To change the COUPLING value, press the CHA or CHB button and then the [**F3**] button (see page 7 table 2).

7) ATTENUATION

- ▫ Displays the current ATTENUATION value.

- ▫ ATTENUATION: X1 or X10 may be selected

- ▫ To change the ATTENUATION value, press the **CHA** or **CHB** button and then the [**F4**] button

8) LPF (LOW PASS FILTER)

- ▫ Displays whether the 100 KHz Low pass filter has been selected.

- ▫ Low pass or normal (No filter) may be selected.

- ▫ To change, press the **CHA** or **CHB** button and then the [**F5]** button.

- (1) The Attenuation, LPF, SLOPE and AC/DC Coupling may also be changed as follows:
  - (a) Press the ⬦⊕ button to display the selection mode cursor (**<** or **>**).
  - (b) Turn the rotary dial to indicate the setting or function to be changed.
  - (c) Press the ⬦⊕ button to display the edit mode cursor (◄ or ►) and turn the rotary dial to display the new setting or function.

9) Measurement value:

The current measured frequency value is displayed or PASS/Fail when in the compare (**COMP**) mode.

10) Period display:
Displays the period (1/F) of the currently displayed frequency measurement.

11) H (HOLD):
This symbol is displayed when the [**HOLD**] button is pressed.
The LCD reading is "frozen" until this button is press again

12) Data from one of the following (PROG) program modes is displayed in this area of the LCD:

(1) MAXIMUM and MINIMUM frequency values when REC (**record mode**) is selected from the (**PROG**) menu. To select REC Press the following button sequence: MENU ➔ PROG(**F1**) ➔ REC(**F1**). This mode records and displays the maximum and minimum frequencies values that the input frequency deviates over a period of time. Pressing the [**F5**] button resets the Maximum and Minimum values

(2) REFERENCE and the % ERROR value in the Relative (**REL**) mode. To select REL press the following button sequence: MENU ➔ PROG(**F1**) ➔ REL(**F2**). The relative mode measures how much the input frequency deviates from a reference frequency and displays the deviation as a % error according the formula: (1- measured value/REF value) x 100.

(a) The REFERENCE (REF) frequency value is changed by pressing the [**EDIT**] button and then the ⬥⊕ button to display the Edit cursor (◄). When the Rotary dial is turned, the cursor changes to a (◄►) symbol and highlights a digit. Rotate the dial until the digit to be changed is highlighted. Press the ⬥⊕ button again to select digit edit mode cursor (⬍) and turn the Rotary dial to change the digit value.
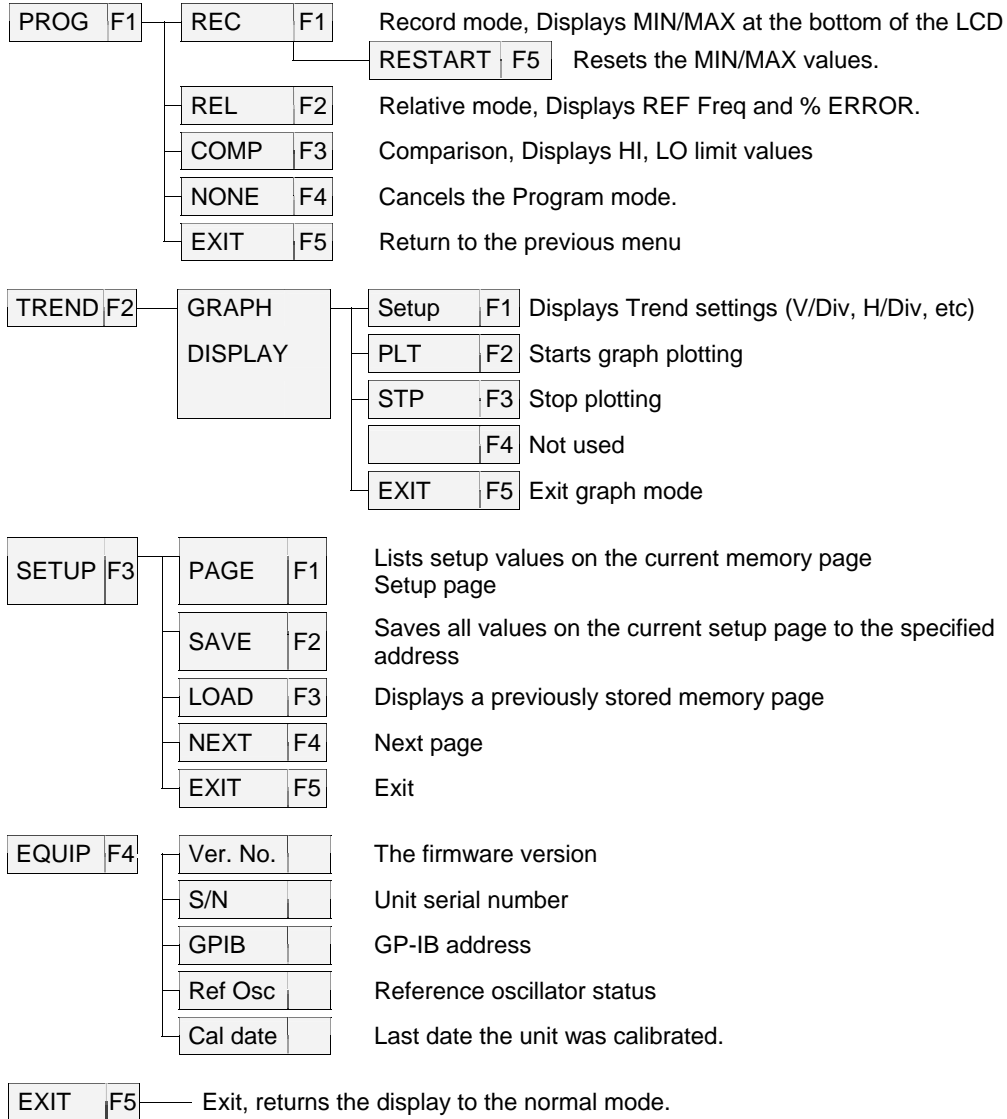
(b) To change another digit press the ⬥⊕ button, turn the rotary dial to highlight the next digit to be changed and repeat step (2a).

(3) HI and LO limit values in the COMPARE (**COMP**) mode. To select COMP press the following button sequence MENU ➔ PROG(**F1**) ➔ COMP (**F3**). This mode compares the input frequency to a high and low frequency limit value. A LO is displayed if the input frequency is lower than the low limit, PASS if the input frequency is within the high and low limit values and Hi if the input is greater than the high limit.

    (a) The HI and LO limit frequency values are entered and edited the same way as explained in the procedure for Reference frequency value in (2a)

(4) If the measurement function (**FUN**) is Time interval **A➔B**, Ratio **A/B** or Difference **A-B**, the channel B setup information is displayed.

(5) When the MENU ➔ PROG(**F1**) ➔ NONE(**F4**) buttons are pressed no data is displayed.

2. MENU description

This section explains the items in the menus and sub menus and the F soft buttons [F1], [F2], [F3], [F4], [F5] for selecting items in the menus.
Table 4 is the diagram of the Menu structure that is displayed when the MENU button is pressed.

PROG	F1		REC	F1	Record mode, Displays MIN/MAX at the bottom of the LCD
			RESTART	F5	Resets the MIN/MAX values.
			REL	F2	Relative mode, Displays REF Freq and % ERROR.
			COMP	F3	Comparison, Displays HI, LO limit values
			NONE	F4	Cancels the Program mode.
			EXIT	F5	Return to the previous menu

TREND	F2		GRAPH DISPLAY		Setup	F1	Displays Trend settings (V/Div, H/Div, etc)
					PLT	F2	Starts graph plotting
					STP	F3	Stop plotting
						F4	Not used
					EXIT	F5	Exit graph mode

SETUP	F3		PAGE	F1	Lists setup values on the current memory page Setup page
			SAVE	F2	Saves all values on the current setup page to the specified address
			LOAD	F3	Displays a previously stored memory page
			NEXT	F4	Next page
			EXIT	F5	Exit

EQUIP	F4		Ver. No.		The firmware version
			S/N		Unit serial number
			GPIB		GP-IB address
			Ref Osc		Reference oscillator status
			Cal date		Last date the unit was calibrated.

| EXIT | F5 | Exit, returns the display to the normal mode. |

[Table 4] Menu structure

1) MENU Description

[**F1**] **PROG** (Program mode): REC(record), REL(relative), COMP (comparison), NONE and EXIT sub menus are displayed.

[**F2**] **TREND**: Displays the trend graph with the reference value as the centerline.

[**F3**] **SETUP**: Displays a list of a settings, data values and the PAGE, SAVE, LOAD, NEXT, EXIT soft Keys for selecting a memory page, saving the current screen or recalling a previously saved counter setup screen. Eight setup screens may be saved or recalled from memory.

[**F4**] **EQUIP**: Displays information about your instrument including the serial number, CALIBRATION date, GP-IB address, Reference oscillator and Firmware revision.

[**F5**] **EXIT**: Exit the menu and return to the normal screen.

2) PROG Menu description

[**F1**] **REC** (Record): Records and displays the MAX and MIN values of the input frequency at the bottom of LCD.

[**F2**] **REL** (Relative): Displays Reference frequency and the deviation of the measured frequency from the reference frequency as a % error.

[**F3**] **COMP** (Comparison): The high and low limit frequencies values are displayed at the bottom of LCD. When a frequency is applied to the CHA or CHB inputs it is compared to the High and Low frequency values. The LCD will display PASS if the input frequency is with in the HI/LO limits, LO if the frequency is lower than the LO limit and HI if the frequency is higher than the HI limit.

[**F4**] **NONE**: Removes the displayed data from the bottom of the LCD screen.

[**F5**] **EXIT**: Returns to the counter display.

3) TREND display description
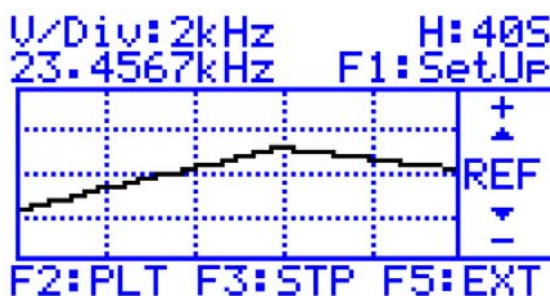
[Figure 6] Trend Display

[**F1**] **SET UP**: The Reference frequency, horizontal and vertical axis values (REF, H/Div, V/Div) are displayed. The REF is the centerline value on the trend graph, H/Div is the X axis (time) and V/DIV is the Y axis (amplitude). Pressing the EDIT button and following the procedure on pages 14 or 19 for editing digit values, the REF, V/Div and H/Div values may be entered or changed. To return to TREND screen press the EXIT button (F5).

[**F2**] **PLT**: Starts the graph plotting using REF value as the centerline.

[**F3**] **STP**: Stops the graph from plotting further values.

[**F5**] **EXT**: Exit from the TREND screen and return to the normal screen.
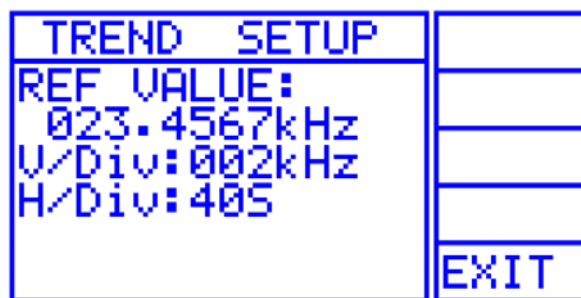
[Figure 7] Trend setup menu screen

[**F5**] **EXIT**: Return to the TREND graph

4) SETUP Menu Description

[**F1**] **PAGE**: Selects the page in memory where the counter settings as shown on page 19 figure 8 are to be saved. Eight setups may be stored from Addresses 0 to 7. To select a memory page press and release the F1 button until the desired memory page is displayed.

[**F2**] **SAVE**: Seven setup screens may be edited and stored prior to using the counter. The functions and data displayed in the list on page 19 may be changed prior to saving by pressing the EDIT button and using the editing procedures as described on page, 14 or 19/20.

Note: Page 0 is reserved for storing the current settings and values. When the unit is power off and then on, these will be the default settings and values.

[**F3**] **LOAD**: Loads a previously saved memory address page to the display. This list now becomes the operating parameters of the counter. Press and release the F1 button until the desired paged is displayed, then press the F3 button. Page 0 is the default page that is loaded into memory when the unit is powered on.

[**F4**] **NEXT**: Go to the next page of menu items.

[**F5**] **EXIT**: Exit the setup menu.

(1) SETUP menu displays the current counter settings, Reference frequency, Compare HI limit and Compare Lo limit values. Pressing the NEXT (F4) button advances the display to the next menu screen; exit returns the display to the normal screen.

SETUP PAGE:0 FUN:FRQ.A G.T:50mS CHA TRG:+05↑ AC X10 NOR CHB TRG:+25↓ DC X1 NOR	PAGE SAVE LOAD NEXT EXIT	**Selects memory page address: 0 to 7** ♦ **FUN:** Displays the currently selected function ♦ **G. T:** GATE TIME setting ♦ **CHA:** Current Channel A settings ♦ **CHB:** Current Channel B settings (CHA and CHB Setup consist of Trigger LEVEL, SLOPE, LPF, COUPLING and ATTENUATOR settings
SETUP PAGE:0 DISP. MODE: NOR PROG. MODE: NONE BEEPER :ON B/LIGHT:OFF	PAGE SAVE LOAD NEXT EXIT	♦ Display mode: Normal or Trend display ♦ Program mode: currently selected program mode(REC, REL, COMP or none) ♦ Beeper on/off ♦ back light on/off
SETUP PAGE:0 REL REF: 2.340000GHz COMP HI LIMIT 2.400000GHz COMP LO LIMIT 2.240000GHz	PAGE SAVE LOAD NEXT EXIT	♦ RELATIVE REF: Reference frequency value ♦ COMPARE: HI Limit and LO Limit frequency values
SETUP PAGE:0 BAUD RATE: 9600 CONTRAST: ------I----	PAGE SAVE LOAD NEXT EXIT	♦ RS 232 Baud rate selection ♦ LCD Contrast adjust

[Figure 8] Setup menu screen

(2) The above screens may be edited to enter new settings or data values by using the following procedure:
(a) Press the [**EDIT**] button to display the Selection mode cursor (**<**).
(b) Turn the Rotary dial until the cursor is indicating the item to be changed.
(c) Press the ⬥⊖ button to select the Edit Cursor (◄).
(d) Turn the Rotary dial until the new setting is displayed.
(e) To change another item in the menu, press the ⬥⊖ button, and repeat steps (b) through (d).

(3) To edit numerical data (Relative Reference, HI/LO Comp) values:
   (a) Turn the rotary dial to indicate the data value to be changed with the selection cursor (**<**).
   (b) Press the ⬥⊖ button to select the edit cursor (◄).
   (c) Turning the rotary dial the cursor changes to a (◄►) symbol and highlights a digit or label (HZ, KHz, etc). Turn the rotary dial to highlight the digit to be changed.
   (d) Press the ⬥⊖ button to select the digit edits mode cursor (⬥). Turn the rotary dial until the new digit or frequency label is displayed.
   (e) To change another digit, press the ⬥⊖ button and repeat steps (c) and (d).

(4) To save this menu page, press and release the [**F1**] button until the desired address page is displayed, then press the [**F2**] button. To exit the menu, press the [**F5**] button. Note Page 0 is reserved for the current settings and values.

(5) To load and display a previously saved menu page.
   Press and release the [**F1**] button until the desired menu page is displayed.
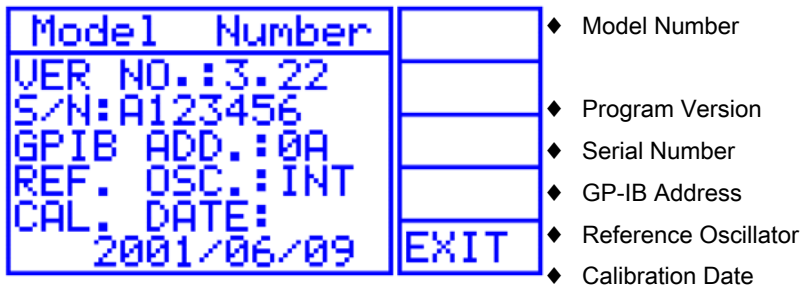   Press the [**F3**] LOAD button.

(6) Press the [**F5**] EXIT button to exit this menu.

5) Equipment menu description:
This menu displays the specific information about a unit. It contains the Model number, Program Version, Serial number, GP-IB Address, Reference Oscillator and Calibration date.

(1) The GP-IB address, reference oscillator and Cal date may be changed using the edit cursor as described above. The Reference oscillator can be changed to external for applying a more accurate time base frequency.

Model Number		◆ Model Number
VER NO.:3.22		◆ Program Version
S/N:A123456		◆ Serial Number
GPIB ADD.:0A		◆ GP-IB Address
REF. OSC.:INT		◆ Reference Oscillator
CAL. DATE: 2001/06/09	EXIT	◆ Calibration Date

[Figure 9] Equipment menu screen

[**F5**] **EXIT** button: Pressing the [**F5**] button returns the to the counter display.

3. Rotary Dial:

1) The Rotary dial is used to move the selection cursor (**<** or **>**) from one item to another in the top section of the LCD or in the set up menu. It changes the value of the settings when it is indicated by the edit cursor (◄ or ►).
It is also used to change numerical data (Relative frequency or HI/LO frequency limit values) when REL or COMP program modes are selected or in the setup menu.

4. Quick Reference Guide
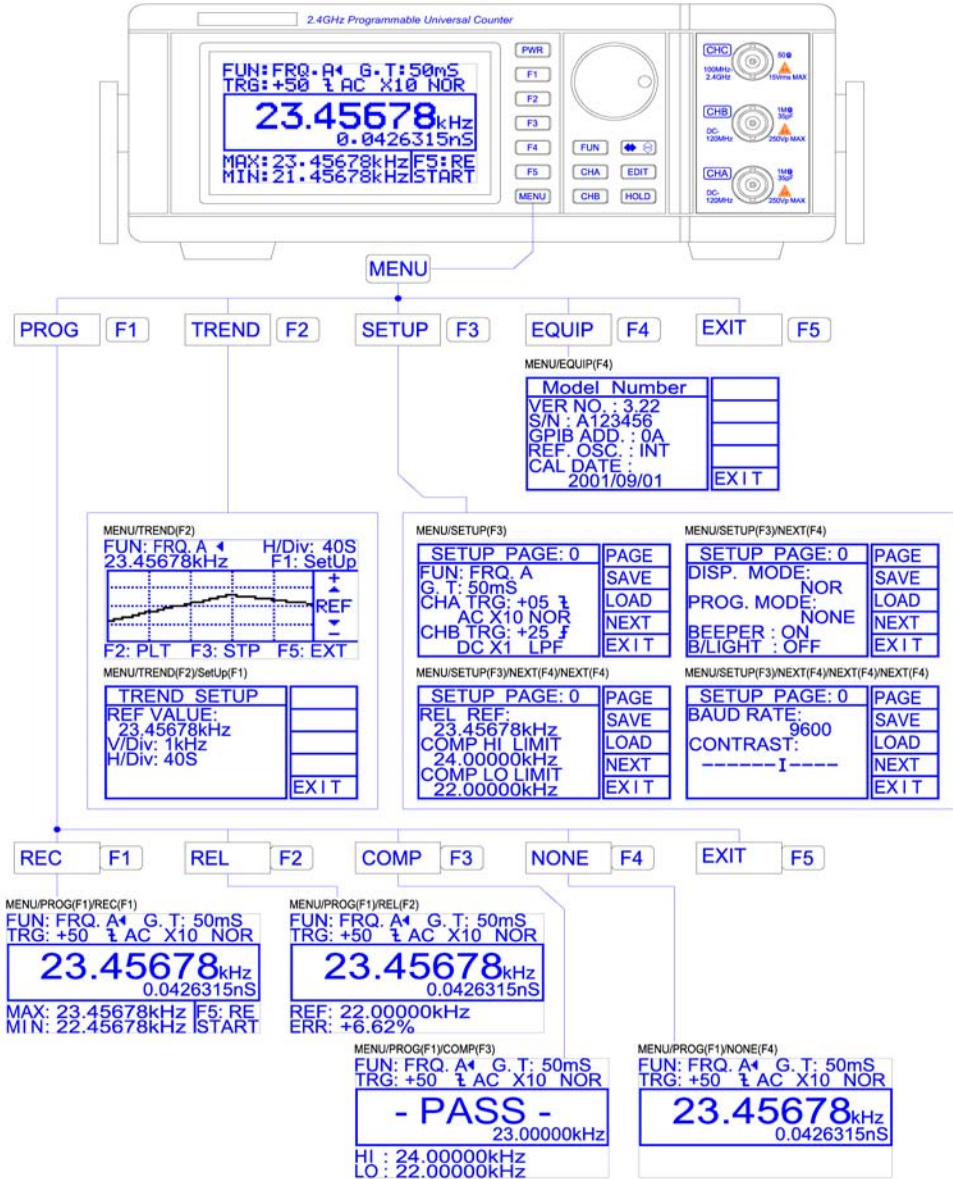
Chapter 5. Using this instrument

1. Preliminary setup

1) Check whether the AC input voltage is within the specified range before turning the unit on. See [**Figure 3**].
2) Connect the AC power cord to the receptacle on the rear panel.
3) Turn on the power by pressing the [**PWR**] button for 1.5~2 seconds.
4) Let the unit warm up for about 10 to 20 minutes before taking measurements.

2. Counter operations

This chapter explains the LCD setting indicators and the 9 modes of operation by showing a typical LCD display and explaining the various indicators.
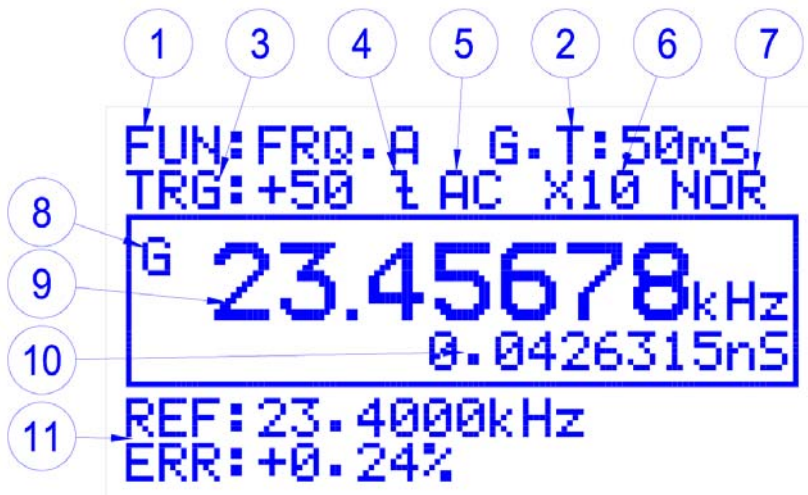

[Figure 10] LCD Display Screen

1) LCD display description

This section explains the LCD display in [**Figure 10**]. This example uses the **CHA** input but it also applies to the **CHB** input.

(1) **FUN:** Displays the function that is currently being used in an application. There are nine functions to choose from [**FRQ.A**, **FRQ.B**, **FRQ.C**, **Time interval (A➔B)**, **TOT.A**, **Ratio (A/B)**, **Difference frequency (A-B)**, **DTY.A**, or **RPM A**]. In [**Figure 10**] **FRQ A** is selected. To change to another function press the FUN button and then its corresponding F button.

(2) **G.T:** Displays the current gate time. This is the period of time the measurement gate is enabled. In the above example the gating time is 50mS. To set another gate time use the following procedure:

(a) Press the edit button to display the selection cursor (**< >**) and turn the rotary dial until it indicates G.T: __

(b) Press the ⬥⊖ to select the edit mode cursor (◄). Turn the rotary dial until the appropriate gating time is displayed on the LCD, and then press the ⬥⊖ button.

(3) **TRG:** The trigger level sets a threshold voltage that the input signal must cross before the count gate is enabled. The trigger level voltage is variable from –1.28 volts to +1.28V displayed as a scale from –99 to +99 units. In **Figure 10** the trigger level is a +50 unit. To set a new Trigger level, move the selection cursor (**<** or **>**) to TRG using the same procedure as explained in G.T. (gate time) steps (a) and (b).

(4) **Slope:** In this example a negative edge is displayed. The input signal's negative going slope will start the count when it reaches the trigger level set in (3). To change the slope, press the CHA and then press the [**F2**] button.

(5) **Coupling method:** The input of CHA is AC coupled. This means the counter input is capacitive coupled. The alternative choice of coupling is DC (direct coupling). To change the coupling, press the CHA button and then press the [**F3**] button.

(6) **Attenuator:** The signal input level value can be applied directly to the input or through a 20dB attenuator. When the 20dB attenuator is selected the signal level is decreased by a factor of 10. Example: If 25 volts is applied to the input the actual signal at the input amplifier is 2.5 volts. To change the Attenuator, press the CHA and then the [**F4**] button.

(7) **Low Pass Filter:** A 100KHz low pass filter can be inserted in to the CHA or CHB input. This filter attenuates the high frequencies and passes low frequencies. In this example it has not been inserted (NOR). The low pass filter is used when the signal has large noise content or the counter is being used in a noisy environment. To insert the Low pass filter, press the CHA button and then the [**F5**] button.

(8) The **G symbol** indicates the gate is opened (enabled) and is making a measurement. It will flash on and off in accordance with the selected gate time.

(9) The measured frequency value applied to CHA input is displayed.

(10) The period of the measured input signal is displayed. The period of a signal is equal to 1/F.

(11) The Ref frequency and Err is displayed when REL is selected from the Program (PROG) menu. To set the Reference frequency:

(a) Press MENU ➔ PROG (**F1**) ➔ REL (**F2**) buttons.

(b) Press the **EDIT** button to display the selection cursor (**<**)

(c) Press the ⬥⊖, button to display the edit cursor (◄). When the rotary dial is turned the cursor changes to a (◄►) symbol and highlights a digit.

(d) Turn the rotary dial to highlight the first digit to be changed.

(e) Press the ⬥⊖. Button to select the digit edit cursor displayed as a (⬥) symbol. Turn the rotary dial to change the digit value. Turning the rotary dial clockwise increases the digit value; counter clockwise decreases the digit value.

(f) When the frequency units are highlighted, rotating the rotary dial clockwise increases the frequency units by a factor of 10 (1KHz, 10KHz, 100KHz, etc and the decimal point is adjusted accordingly. Example: 150.000KHz ➔ 1.5MHz ➔ 15.000 MHz

(g) To change another digit press the ⬥⊖.
Button and repeat steps (b) through (g).

(h) The Error is calculated from the equation.
(1-Measured value/Reference frequency) x 100.

3. Counter Function descriptions

The 9 functions performed by this instrument and how to use them are explained in this section. These functions include:

1) FRQ A

(1) Enables the CHA input to receive an input signal and is used in conjunction with the FRQ B input for time interval (A➔B) and frequency ratio A/B measurements. When using this function it is necessary to connect the signal to CHA input. Gate time, and trigger level values must be entered and the appropriate coupling and slope selected. To Select FRQ A press the FUN button and then the [**F2**] button.

   (a) To select the slope or couplings press the CHA button and then the corresponding F button.

   (b) To set the Gate time: Press the ⬕⬕, button to display the selection cursor (< or>). Move the cursor to indicate G.T__ by turning the rotary dial. Press the ⬕⬕, button again to select the edit cursor (◄ or ►) and turn the rotary dial to display the new gate time.

   (c)   To set a trigger level Press the ⬕⬕, button to display the selection cursor (< or>). Move the cursor to indicate TRG_ _ _

   Press the Press the ⬕⬕, button again to select the edit cursor (◄ or ►) and turn the rotary dial to display to display the desired trigger level.

(2) The Min/Max frequency values may be displayed at the bottom of the LCD by pressing the MENU ➔ PROG (**F1**) ➔ REC (**F1**) buttons.

(3) To display Relative (REL) frequency and % error press MENU ➔ PROG (**F1**) ➔ REL (F2) buttons.

(4) The Trend Graph may be displayed by pressing MENU ➔ TREND (**F2**).

2) FRQ.B

(1) This input has identical characteristics as FRQ A and can be used independently or in conjunction with FRQ A for Time interval (A(B) and frequency Ratio A/B measurements.

(2) Select FRQ B by pressing the FUN button and then the [F2] button. To select the trigger level, slope or couplings press the CHB button and the corresponding F buttons.

(3) The MIN/Max and Relative frequency are set up the same way as explained in Steps1a and b of FRQ A.

3) FRQ.C

(1) FRQ C is for high frequency measurements. The measurement range is from 100MHz to 2.4GHz. The input is AC coupled only and the trigger level is fixed.
Caution must be used with this input due to the 50ohm input impedance and the 5V rms maximum input voltage.

(2) To select the FRQ C input, press the FUN button and then the [F3] button.

(3) The MIN/Max or Relative (REL) frequency is set up the same way as explained in steps (2) and (3) of FRQ A.

4) Time interval (A(B)

(1) Time interval measures the time between a starting event on CHA and a stop event on CHB. The inputs may be a separate pulses or the positive transition of a pulse on the CHA input and the Negative transition of the same pulse on the CHB input for pulse width Measurements.

(2) Press the FUN button then the **[F4]** button to select A➜B. Connect the start pulse or transition to the CHA input and the stop pulse or transition to the CHB input.

(3) The Trigger level, coupling, and slope must be set for each channel using the procedure in (1) FRQ. A. Steps 1a, 1b. and 1c

(4) The FRQ B slope, Trigger level, coupling and LPF settings are displayed at the bottom of the LCD.

5) Totalize measurement (TOT.A)
(1) Select Totalize by Pressing the FUN ➜ MORE(**F5**) ➜TOT.A(**F2)** buttons

(2) Connect the signal source to the CHA. input and

(3) Set the trigger level, coupling, gate time, slope and LPF according to the procedure in (1) CHA.

(4) The display will increment up from 0. To stop the counts press the HOLD button. Pressing the HOLD button again will restart the count.

6) Ratio A/B

(1) This function measures the ratio of the signals applied to the CHA and CHB inputs.

(2) To select Ratio A/B press the FUN ➔ MORE (**F5**) ➔ F3 (A/B) buttons

(3) Apply the signal levels to the CHA and CHB inputs.
NOTE: the frequency range of CHA is 10MHz to 120MHz and the CHB frequency range is 0.1MHz to 10MHz.

(4) The Trigger level, coupling, and slope are set up the same way as explained in Steps 1a,1b and 1c of FRQ A.

(5) The FRQ B slope, Trigger level, coupling and LPF settings are displayed at the bottom of the LCD.

7) Difference (A-B)

(1) The difference between the frequency applied to the CHA input and the frequency applied to the CHB input will be displayed on the LCD

(2) Select (A-B) by pressing FUN ➔ MORE (**F5**) ➔ F4 (**A-B**) buttons.

(3) Connect the subtrahend frequency to the CHA and the Minuend frequency to CHB input.

(4) The Trigger level, coupling, and slope are set up for each channel the same way as explained in Steps1a and b of FRQ A.

(5) The FRQ B slope, Trigger level, coupling and LPF settings are displayed at the bottom of the LCD.

8) DTY. A

(1) The duty cycle is the ratio of the pulse width divided by the period.

(2) Select DTY A by pressing the FUN➔MORE (**F5**) ➔MORE (**F5**) ➔ [**F2**] buttons.

(3) Connect the signal source to the CHA. input

(4) The trigger level, coupling, gate time, slope and LPF are set up the same way as explained in Steps1a and b of FRQ A.

9) RPM A

(1) The RPM is equal to the Frequency/60. The maximum RPM that can be measured is 600,000RPM

(2) Select RPM A by pressing the FUN ➔MORE(**F5**) ➔MORE(**F5**) ➔ [**F3**] buttons.

(3) Connect the signal source to the CHA. input

(4) The trigger level, coupling, gate time, slope and LPF are set up the same way as explained in Steps1a and b of FRQ.

4. Program examples

1) The procedure for Setting the HI and LO limit value in the COMP mode:

(1) Select The Compare (COMP) by pressing MENU ➔ PROG(**F1**) ➔ REL(**F3**)

(2) Press the EDIT button, to display the selection cursor (**<**). The cursor will be indicating the HI limit value.

(3) Press the ⬕⬔, to select the edit cursor (◄)

(4) Turn the dial until the cursor highlights the most significant digit. Note: when the rotary dial is turned, the cursor changes to a ((() symbol and highlights a digit Example: 025.1253 MHz. Turning the rotary dial further highlights the next consecutive digit.

(5) When the digit to be changed is highlighted press the   . Button, the cursor then changes to a (() symbol. The highlighted digit will increase if the rotary dial is turned clockwise; counter clockwise decreases the digit value

(6) When changing a highlighted frequency unit, rotating the rotary dial clockwise increases the frequency by factors of 10 (1KHz, 10KHz, 100KHz, etc) and the decimal point is adjusted accordingly.
Example 1.00000KHz (10.0000 KHz (100.000KHz

(7) When finished changing digits, turn the rotary dial clockwise until the   (◄) symbol for the cursor is displayed.

(8) Press the ⬕⬔. Button to display the selection cursor (**<**). Turn the rotary dial to indicate the LO limit frequency

(9) Repeat steps 3 through 7 to change the LO limit frequency.

2) Trend Plot Setup:

The trend plot displays a graph on the LCD. The trend plot and setup screen is shown in **Figure 11A** and **B**.
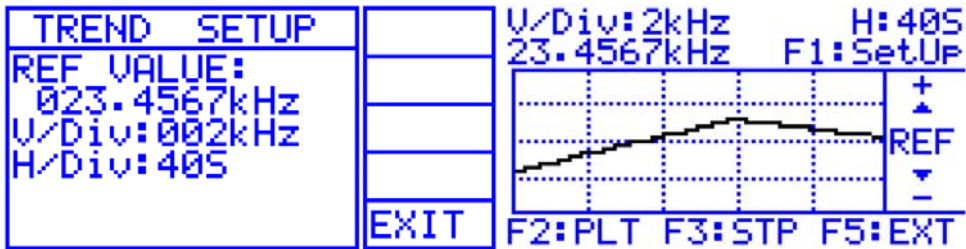
Figure 11A	**11B**

(1) The reference frequency value is centerline as shown in **Figure 11B**. The Horizontal divisions in the example are 40 seconds per divisions. The H/Divisions may be set from 20S/Div to 5Hrs/DIV. The V/DIV may be set to any frequency and depends on the desired resolution; in this example the V/DIV is 2kHz/Div.

    (a) To select The Trend graph, press the MENU ➔ Trend (**F2**) then Press [**F1**] to display the setup screen

    (b) Press the EDIT button, to display the selection cursor (**<**). The cursor will be indicating the REF value. Press the ⬥⊝, to display the edit cursor (◄)

    (c) Turn the dial counter clockwise until the cursor highlights the first digit to be changed. Note: when the rotary dial is turned, the cursor changes to a (◄►) symbol and highlights a digit. Turning the rotary dial further highlights the next consecutive digit.

    (d) Press the ⬥⊝. Button to display the Digit Edit cursor (♦). Turn the dial to display the desired digit. Turning the dial clockwise increases the digit value; counter clockwise decreases the digit value.

    (e) To edit another digit, press the ⬥⊝. Button and turn the dial to highlight the next digit and repeat step (d).

    (f) When changing the highlighted frequency unit, rotating the rotary dial clockwise increases the frequency by factors of 10 (1KHz, 10KHz, 100KHz, 1MHz,etc) and the decimal point is adjusted accordingly.

    (g) When finished changing the digits, turn the rotary dial clockwise until the (◄) symbol for the cursor is displayed.

(2) Setting the V/DIV
    (a) Press the ⬥⊝. Button to display the selection cursor (**<**). Turn the rotary dial to indicate V/DIV. Repeat steps 1c thru 2g to set the V/DIV value.

(3) Setting the H/Div.
The H/DIV is the rate the plot moves across the screen. It can be set from 20S/div to 5Hours/Div.

To set the H/Div:

(a) Press the Press the ⬖⬗. Button to display the selection cursor (**<**). Turn the rotary dial to indicate H/DIV.

(b) Press the ⬖⬗. Button to select the Edit cursor (◄) and turn the rotary dial to select the desired H/DIV.

(c) Press the EXIT [**F5**] button when finish with the set up to return to the Trend graph.

(d) Press the [**F2**] (PLT) button to start the Plot, [**F3**] (STP) to stop the plot.

4. RS232C Interface

1) Hardware and Software requirement:
(1) IBM PC/XT/AT (8088,80286,80386,80486) or Compatible Computer.
(2) Microsoft Windows VER 3.1 OR Windows 95,98, 2000.
(3) Serial Port for Connection with Instrument.

2) RS232 Cable Pin Connection

DMM		Computer		
D-sub 9-Pin Male		D-sub 9-Pin Female	D-sub 25-Pin Female	Pin Name
2	————	2	3	Rx
3	————	3	2	Tx
4	————	4	20	DTR
5	————	5	7	GRD
6	————	6	6	DSR
7	————	7	4	RTS
8	————	8	5	CTS

3) Installation of Supplied Software
(1) Insert the supplied diskette into the Drive A. (or B).
(2) Select File from the Program Manager screen, and then select Run.
(3) Type A:\(or B:\) Setup.exe. Then ENTER.
(4) If you are using Windows 95/98/2000/ME click the mouse on MY computer ICON, then Floppy DRV A icon. When the menu is displayed click on SETUP.EXE
(5) The C3100 Program will be installed and create a directory named "**Model No.**" automatically in Hard Disk.

4) Connection of PC and Instrument:
Connect the RS-232 cable to the built-in RS-232 connector on the Instrument and to the PC serial port.

5) Communication with PC
(1) Start the program by clicking the mouse on the PROTEK C3100 icon
(2) Click on the $\boxed{\text{SetUp}}$ Button to open the setup dialog. Then select appropriate Serial Port and Baud Rate and click on the OK button.
(3) Click on the S TIME button and type in the appropriate sampling time
(4) Click the "START" button with mouse to start the program.
  $\boxed{\text{Start}}$: Starts the program.
  $\boxed{\text{Stop}}$: Stops the program.

Note
For detailed operation instructions, refer to the "Readme.doc" file on the supplied diskette.