1990 SERIES BENCH PROGRAMMABLE UNIVERSAL COUNTERS MODELS 1990, 1991 AND 1992

Models 1991 and 1992 Universal Counters

Direct Frequency Measurement to 1.3GHz (160MHz Model 1991)

1nsec Single Shot Time Interval

9-Digit Resolution in 1 second

Automatic Triggering

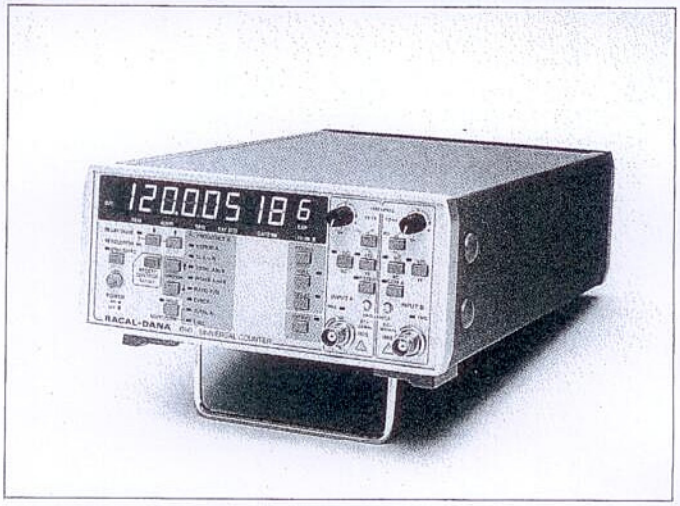
Full GPIB Control

Phase Measurement

Signal Peak Amplitude Measurement

Math Capability

Battery Operation



Model 1990 Universal Counter

Frequency Measurement to 120MHz

Two High Performance DC Amplifiers

Wide Range of Functions, Including Phase

Null, Delay Hold-Off and Averaging

10nsec Time Interval

Battery Operation

GPIB Programmable with Fast Output Rates

Introduction

The Racal-Dana universal counters, Models 1991/1992 offer a unique combination of superior performance and measurement capability in a compact, half-rack package.

The 1990, 1991 and 1992 microprocessor-based counters provide outstanding operational simplicity with exceptional versatility. The measurement functions, which include freqency, period, time interval, ratio, totalize and phase benefit from full GPIB programming, an internal timing delay generator and math capability.

The 1991/2 also include exceptional peak amplitude measurement, external arming and 1.3GHz capability.

General Description

Outstanding Resolution

Models 1991 and 1992 feature a remarkable 9-digit resolution in 1 second whatever the frequency. This enhanced recipromatic technique (TEC) provides an effective clock frequency of 1GHz to give exceptional resolution and single shot time-interval measurement to 1 nanosecond.

Input Control

A selectable filter and attenuator give useful control when dealing with noisy signals. Manual control of trigger levels enable specific triggering voltages to be set accurately for precise timing measurements. A Tri-state TRIG LED for each input quickly and clearly indicates when the trigger level is set correctly.

Delay Hold-Off

To avoid pulses or edges operating as unwanted stop commands, the delay hold-off feature can be used to prevent the measurement being terminated prematurely.

Auto Trigger (1991/1992)

Fast, fully automatic trigger control guarantees optimum triggering for the vast majority of measurement applications.

Manual control of trigger level is also provided by direct entry of the desired trigger voltage or slew controls. The trigger voltage, mean, positive peak or negative peak of the input signal can be displayed.

Math Capability

The 1991 and 1992 have the capability to offset and scale measurements to provide a readout in whatever units are most convenient to the user. Examples include miles-per-hour, litres-per-second, r.p.m., percent, parts-per-million or any exponent format, allowing results to be interpreted quickly and easily – no conversion, no calculations.

The 1990 counter incorporates a simpler single key null capability which enables measurement to be made relative to a previously measured value or to any value entered over the GPIB.

Averaging (1990)

This feature allows 100 measurements to be averaged. This can be used for obtaining an averaged reading or for improving the resolution on Time Interval and Phase Measurements.

External Arming (1991/1992)

Comprehensive external arming ensures total measurement control. With the START and STOP selectively inhibited by the application of an external arming signal, individual pulses or bursts may be extracted from a complex waveform for special attention.

GPIB Control (IEEE-STD-488)

The highly versatile GPIB option allows front panel keys, including the majority of signal conditioning controls, to be programmable – ideal for both bench configurable or ATE applications.

These counters provide more measurement power than any other bench counter and more capabilities than many expensive systems instruments.

Choice of Frequency Standards

A wide range of internal frequency standards is available to provide the counters with the ideal accuracy and stability for any application. A standby mode ensures that the frequency standard maintains optimum stability.

DC Supply Operation

For field applications, an internal rechargeable battery option provides the counter with a go-anywhere capability.

An external DC input of 11-16V is also included allowing the counters to be powered from a vehicle or other external DC supply.

SPECIFICATION

Input Characteristics

Inputs A and B

Frequency:

Input A	DC to 160 MHz DC coupled 10Hz to 160 MHz AC coupled	1991/2
	DC to 120MHz DC coupled 10Hz to 120MHz AC coupled	1990
Input B	DC to 100 MHz DC coupled 10Hz to 100MHz AC coupled	

Signal Operating Range:

x1 attenuation	±5.1V	1991/2	±2.5V 1990
x 10 attenuation	±51V		±25V

Input Impedance (nominal) (1991/2)
(x1 and x10 atten)

Separate Mode	50ohms or 1 Megohm//≤45pf
Common Mode	50ohms or 1 Megohm//≤55pf

Input Impedance (nominal) (1990)
Separate Mode (x1/x10) 1Mohm//≤45pF

Common Mode (x1), (x10)	500kohm//≤55pF;1Mohm//≤55pF

Maximum Input (without damage)

50ohms	5V(DC + ACrms)
1 Megohms (x1 attenuation)	260V(DC + ACrms), DC to 2kHz Decreasing to 5Vrms at 100kHz and above.
1 Megohm (x10 attenuation)	260V(DC + ACrms), DC to 20kHz Decreasing to 50Vrms at 100kHz and above.
Coupling:	AC or DC.
Low Pass Filter:	50kHz nominal (Input A selectable).
Trigger Slope:	+ve or –ve
Attenuator:	x1 or x10. In 1991/2 Auto Trigger mode, attenuator selected automatically if necessary.

Trigger Level Range:

Manual				
x1 attenuation	±5.1V	1991/2	±2.8V typical	1990
x10 attenuation	±51V		±28V typical	
Automatic	±51V			

Trigger Level Accuracy: (1991/2)

Manual and Automatic

x1 attenuation	±30mV ±1% of trigger level reading.
x10 attenuation	±300mV ±1% of trigger level reading.

Auto Trigger:

Frequency Range	DC and 50Hz to 100MHz (Typically 160MHz)
Min.Amplitude (AC):	Typically 150mV p-p
x10 attenuator	Automatically selected if input signal exceeds ±5.1V or 5.1V p-p

Trigger Level Outputs

Range	±5.1V (1991/2) ±2.8V typical (1990)	
Accuracy (Relative to true trigger level)		
x1 attenuation	±10mV ±1% V output	(1991/2)
x10 attenuation	±100mV ±1% V output	
x1 attenuation	±10mV ±5% of V output	(1990)
x10 attenuation	±100mV ±7% of V output	
Impedance	10 kohm nominal.	

Input C (1992 only)

Frequency Range:	40MHz to 1.3GHz
Sensitivity: Sine Wave	<10mVrms, 40MHz to 1GHz <75mVrms at 1.3 GHz
Dynamic Range:	10m Vrms to 5Vrms to 1GHz 75m Vrms to 5Vrms to 1.3GHz
Input Impedance:	50 ohms nominal (AC coupled)
VSWR:	≤2:1 at 1GHz
Maximum Input:	7Vrms (fuse protected) Fuse located in BNC connector
Damage Level:	25W

1990 SERIES BENCH PROGRAMMABLE UNIVERSAL COUNTERS MODELS 1990, 1991 AND 1992

Measurement Modes

Frequency A

Range:	DC to 160MHz. (1991/2) DC to 120MHz. (1990)
Digits Displayed:	3 to 9 digits plus overflow. (8 digits 1990)
LSD Displayed: (Hz)	$F \times 10^{-10}$ (D = No. of digits, F = Freq.)
Resolution *(Hz)	±LSD† ±(Trig. Error* x Freq.)/Gate Time
Accuracy *(Hz)	±Resolution ±(Timebase Error x Frequency)

Time Interval

Range (1991/2):	
Separate Mode:	0 to 8×10^5sec
Common Mode:	5nsec to 8×10^5sec
Range (1990):	
Single	100ns to 8×10^5sec
Averaged	10ns to 8×10^5sec
Input:	
Common	Input A START and STOP
Separate	Input A START Input B STOP
Trigger Slopes:	+ ve or -ve Selectable START and STOP
LSD Displayed:	1ns min. (1991/2) 100ns min. (10ns with averaging) (1990)
Resolution: (sec)	±LSD ±1ns ±Trig. Error* (1991/2) ±LSD ±5ns ±Trig. Error (1990)
Accuracy: (sec)	±Resolution ± (Timebase Error × TI) ±Trigger Level Timing Error* ±2ns**

Time Delay

Available on Time Interval and Totalize

Range:	200μs to 800 ms nominal
Step Size:	25μs nominal (1991/2) 1ms (1990)
Accuracy:	±0.1% Rdg. ±50μs

Period A

Range:	6.25ns to 1.7×10^3sec (1991/2) 8.3ns to 1.7×10^3sec (1990)
Digits Displayed:	3 to 9 digits plus overflow (8 digits 1990)
LSD Displayed: (sec)	$P \times 10^{-D}$ (D=No of digits, P=Period rounding up to next decade)*
Resolution: *(sec)	±LSD† ±(Trig. Error* x period)/Gate Time
Accuracy:*(sec)	±Resolution ±(Timebase Error x Period)

Ratio A/B

Specified for higher frequency applied to Input A.

Range:	DC to 100MHz on both inputs
LSD Displayed: (for 6-9 digits selected)	$\left(\frac{10}{\text{Freq.B x Gate Time}}\right)$, rounded to nearest decade*.
Resolution*:	±LSD ±(Trig. Error B*/Gate Time) x Ratio.
Accuracy*:	±Resolution.

Totalize A

Accumulative or single totalize.

Input:	Input A
Start/Stop:	Electrical (Input B) or Manual
Range:	10^{12}-1
Maximum Rate:	10^8events/sec
Minimum Pulse Width:	5ns min. at trigger points
Accuracy:	±1 count

Phase (A rel. to B)

Range:	0.1° to 360°
LSD Displayed: (1991/2)	0.1° to 1MHz 1.0° to 10MHz 10° to 100MHz
LSD Displayed: (1990)	Normal (averaged) 1° (0.1°) to 100kHz 10° (1°) to 1MHz 100° (10°) to 5MHz
Resolution *(degrees)	±LSD ± (TI Resolution/Period A) x360°
Accuracy *(degrees)	±LSD ± (TI Accuracy/Period A) x360°

External Arming 1991/2

A comprehensive external arming capability to determine the START and/or STOP point of a measurement. Available on all measurement functions except phase.

Input Signal: (via Rear Panel):	TTL compatible (min. pulse width 200ns)
Slope:	+ ve or −ve independently selectable on START or STOP arm.
Impedance:	1kohm nominal

Frequency C 1992 only

Range:	40MHz to 1.3GHz
LSD:	As for Frequency A*
Resolution* and Accuracy*	As for Frequency A

Ratio C/B (1992 only)

Specified for higher frequency applied to Input C.

Range:	Input C 40MHz to 1.3GHZ. Input B DC to 100MHz.
LSD Displayed: (for 6-9 digits selected)	$\left(\frac{640}{\text{Freq.B x Gate Time}}\right)$, rounded to nearest decade*.
Resolution* and Accuracy*	As for Ratio A/B.

*See definitions page 14.

**A differential delay which may be reduced by numerical offset or external compensation.

1990 SERIES BENCH PROGRAMMABLE UNIVERSAL COUNTERS MODELS 1990, 1991 AND 1992

Amplitude Measurement (1991/2)

Peak*:

Frequency Range	DC and 50Hz to 20MHz.
Amplitude Range	160mV p-p to 51V p-p.
Resolution	20mV (x1) 200mV (x10)
Accuracy Peak	
x1 attenuation	Typically ±40mV ±2%V p-p
x10 attenuation	Typically ±400mV ±3%V p-p
Accuracy (DC)	
x1 attenuation	±40mV ±1%V Rdg.
x10 attenuation	±400mV ±1%V Rdg.

Math 1991/2

Available on all measurements except Phase and Check.

Function: (Result–X)/Z.

Other 1990 Functions

NULL

Function: Displays (Result – Null)

Available on all measurements except Phase and Check.

TIME

Start/Stop: Manual

Range: 40ms to 8 x 10^5sec

Resolution: ±40ms

Accuracy: ±Resolution ±(Timebase Error x Time)

100AV

Function: Displays average value of 100 measurements.

Averaging Time: 2.5 sec + (100 x single measurement time)

General

Internal Timebase:

Crystal Controlled

Frequency: 10MHz.

Aging: 2 x 10^{-6} in the first year.

Temperature Stability: ±1 x 10^{-5} over the range 0 to +50°C.

Power Requirements:

Voltage (AC) 90- 253V externally selectable

Frequency 45-440Hz

Rating 35VA Max.

Operating Temperature Range: 0° to +50°C (0° to +40°C with battery pack)

Storage Temperature Range: -40°C to +70°C (-40°C to +60°C with battery pack).

Environmental: Designed to meet MIL-T-28800, DEF-STD 66/31 and IEC 68.

Safety: Designed to meet IEC348 and UL1244.

RFI/EMC: MIL-STD-461B.

Weight: Net 3.6kg (8lb) excl. battery
6.8kg (15lb) incl. battery
Shipping 5.5kg (12lb) excl. battery
8.75kg (19.3lb) incl. battery.

Dimensions: 331 x 218 x 101mm
(13.03 x 8.58 x 3.98 ins)

NB. Full details of options available will be found on page 14.

Ordering Information

1990	120MHz Universal Counter
1991	160MHz Universal Counter
1992	1300MHz Universal Counter

Options and Accessories

01*	Rear Panel Inputs (1991)	11–1709
01*	Rear Panel Inputs (1992)	11–1732
02	Frequency Standard Input/Output (1990)	11–9000
04T**	TCXO	11–1713
#04A**	Oven Oscillator	11–1710
#04B**	High Stability Oven Oscillator	11–1711
07†	Battery Pack	11–1625
#10	Reference Frequency Multiplier	11–1645
55†	GPIB Interface (1990)	11–9201
55†	GPIB Interface	11–1626
60	Handles	11–1730
60A	Rack Mounting Kit (Fixed, Single)	11–1648
60B	Rack Mounting Kit (Fixed, Double)	11–1649
61	Carrying Case	15–0773
61M	Protectomuff Case	15–0736
	Telescopic Antenna	23–9020
	High Impedance Probe (100MHz/1MΩ)	23–9104
	1.3GHz Fuse (Pkt. 5) – 1992	11–1718

**Fitting Option 01 may affect certain specification parameters.*

***Only one frequency standard may be fitted at any one time.*

The standard reference will be supplied unless option 04T, 04A or 04B is specified.

†The battery pack and GPIB options cannot both be fitted.

 # On model 1990 only, option 02 must also be purchased with these options.