

1.3 APPLICATIONS

The Model 213C is used in the following applications.

- Phase-Sensitive Null Indicator
- Measures separately the in-phase and quadrature components of an ac signal.
- Measures phase shift in any ac system.
- Sensitive ac electronic voltmeter
- Testing of servos, computers, synchros, resolvers, inductosyn.
- Precise ac ratiometry
- Phasing of servo motors, chopper amplifiers, magnetic amplifiers.
- Measuring both torque and non-torque producing signals in servo amplifiers.

- Align carrier amplifier and notch networks.
- Impedance meter
- Power factor meter
- Measuring response of vibrational system.

Detailed descriptions of these applications are shown in the Application Notes in Appendix A.

1.4 GENERAL SPECIFICATIONS

The specifications in table 1-1 apply to the Model 213C Phase Angle Voltmeter. Where a special modification or variation is involved, the governing specification will either be a separate specification control document, the purchase order, or a supplement contained in this manual. Specifications for individual instruments are always identified by a specification "S" number appearing on the instrument nameplate - e.g. 213C-S1234.

Table 1-1. Specifications

Item	Specification
Voltage range (full scale output)	300 μ V to 300 V in 13 ranges
Frequency ranges	
Total mode - direct input	10 Hz to 100 kHz
Transformer input	20 Hz to 3 kHz*
Fundamental and phase sensitive modes	Single prespecified frequency with $\pm 5\%$ bandwidth in a range between 30 Hz and 10 kHz.
Voltage accuracy	
Total mode - direct input	$\pm 2\%$ of full scale, 20 Hz to 50 kHz $\pm 5\%$ of full scale, 50 kHz to 100 kHz
Transformer input	$\pm 2\%$ of full scale, 60 Hz to 2 kHz* $\pm 5\%$ of full scale, 20 Hz to 60 Hz, 2 kHz to 3 kHz
Fundamental and phase sensitive modes	$\pm 2\%$ at phase sensitive frequency of operation.
Phase accuracy	$\pm 1^\circ$ as read on the calibrated Phase dial, $\pm 3\%$ full scale angle using $E \cos \theta$ characteristic (See Application Notes)

Table 1-1. Specifications (Continued)

Item	Specification
Calibration	
Voltage	Zero center, low stiction meter calibrated 3-0-3 and 10-0-10 scales
Phase dial	Continuously calibrated in 1° increments from -6° to +96° over four quadrants 0°, 90°, 180°, 270°.
Resolution	-0.2°
Signal input impedance	
Direct mode	10 megohms shunted by 75 μ f nominal (150 μ f with rear input terminals)
Transformer mode	300k Ω min. at 400 Hz
Reference input impedance	300k Ω (nom.) (100k Ω nom. for frequencies below 400 Hz)
Reference input voltage	1.5 V to 200 V max., 400 Hz to 10 kHz; 3.8 V to 200 V max. below 400 Hz.
Signal input dc voltage level	
Transformer mode	0 V (with no external blocking capacitor)
Direct mode	400 V
Transformer common mode rejection (at 400 Hz)	
Zero source impedance	.0025% max.
1 K source impedance	.004% max. (1 K in series with high input) .006% max. with rear input terminals
Overload	10 x full scale signal input OVERLOAD light will completely ignite at approximately 12 x full scale setting.
Noise	Less than 15 μ V, Total and Fundamental modes
Nulling sensitivity	Less than 2 μ V, Phase Sensitive modes.
Fundamental mode frequency response	See diagram (fig. 4-4)
Harmonic rejection phase sensitive modes	
At 400 Hz	55 DB
All other frequencies of operation	40 DB to 70 DB depending on frequency of operation (see fig. 4-4)

*Typical for pre-specified phase sensitive frequency of 400 Hz.

Table 1-1. Specifications (Continued)

Item	Specification
Non-coherent signal rejection	For frequencies removed from signal frequency by approximately 5 Hz or more (effective pass band of meter movement), response is essentially zero for levels up to 10 x the value of the full scale range in use. Internal filters will increase the allowable level of the non-coherent signal to 300 x the value of the full-scale range in use on the most sensitive ranges, provided the non-coherent signals are in the stop band of the filter.
Power	115 V/125 V or 230 V/250 V $\pm 10\%$, 45-440 Hz, 10 VA
Fuse	
For 115 V/125 V power	.5 A, type 3 AG. S.B.
For 230 V/250 V power	.25 A, type 3 AG. S.B.
Size	
Panel	5-1/4" x 19" W
Depth behind panel	12"
Width behind panel	16-3/4"
Weight	Approximately 15 lbs.
Mounting	Rack or bench mounted.
Front panel paint	Semi-gloss gray #26280
Line cord	6' long with ground pin
Front panel input	Inputs are standard, 5-way binding posts, spaced on 3/4" centers.