

**213**

BENTHAM 213 DIFFERENTIAL INPUT VOLTAGE AMPLIFIER1. INTRODUCTION

The 213 is a differential input voltage amplifier which may be used for a.c. or d.c. voltage measurement or as a preamplifier for other 200 series modules. Superior FET - bipolar integrated circuits are used to achieve low drift coupled with high input impedance and low noise.

The unit has high and low pass filters which are useful for improving signal to noise ratio when wide bandwidth is not required.

The high common mode rejection will be found particularly useful in applications where pick-up of interference is a problem.

Other features include:- Switched and continuously variable gain, output offset control and output switching into the 200 series bus line system.

2. INITIAL SETTING UP2.1 External system requirements

The 213 requires a power supply which will provide  $\pm 15V$ , 0V at 100mA. This supply is normally provided via the rear flying lead connector by a 217 bin/power supply. The bin also provides facilities for a 216 display module with a display bus system to enable the outputs of several modules in a bin to be selected for display, without the need for external leads. The 216A, end zero analogue display or the 216D,  $3\frac{1}{2}$  digit display are recommended for use with the 213.

2.2 Initial Control Settings

Set:- GAIN to 100  
VARIABLE to CAL.  
HIGH PASS to d.c. or (for a.c. measurements) to 0.5Hz.  
LOW PASS to 10Hz or (for a.c. measurements) to 100kHz  
OUTPUT bus select switch to A.

N.B. Check that no other module in the bin has its OUTPUT bus select switch also in the A position.

Select the A bus for display on the 216 module.

2.3 Check the mains voltage setting on the bin on the label on the rear panel. If this is incorrect, change the setting according to the 217 OPERATING INSTRUCTIONS.

Connect the bin to the mains and switch ON the POWER switch (situated on the 216 panel). Check that the POWER indicator is illuminated.

- 2.4 Short circuit both signal inputs. Adjust the centre zero OFFSET potentiometer to obtain an output of 0V.

For differential amplification, connect the HIGH and LOW signals to the relevant SIGNAL INPUTS. The common mode voltage range is  $\pm 10V$ .

For single ended amplification (non-inverting) short circuit the LO input and connect the signal to the HI input. Reverse these connections if inverting amplification is required.

If d.c. measurements are to be made, the output of the 213 may be observed on the 217 meter or by connecting an external meter to the 213 output socket.

If a.c. measurements are to be made, the output of the 213 should be isolated from the display bus system by switching the OUTPUT bus select switch to OFF. Connection should then be made between the 213 OUTPUT socket and the input of a 223 lock-up amplifier or another a.c. detector.

When the 213 is used as a preamplifier for the 223 lock-in amplifier, a GAIN setting of X100 is recommended. The filters should be set to 0.5Hz and 100kHz. Only if the 223 is overloaded by discrete frequency noise (e.g. 50Hz or 100Hz) will closing down the filters improve the performance of the system and problems caused by signal frequency drift are avoided if wide band filters are used.

### 3. CONNECTORS, CONTROLS AND INDICATORS

- 3.1 SIGNAL INPUTS, Standard B.N.C.

Input impedance 100M $\Omega$  30pF

Input common mode rejection 100,000X at 100Hz.

Maximum common mode voltage 10V peak

Noise referred to input 10nV/Hz at 1kHz

15nV/Hz at 100Hz.

Protection Protected against connection to abnormal high voltages.

- 3.2 GAIN switch and VARIABLE control

The switch selects amplifier gains from X1 to X1000 in conventional 1, 3, 10 steps.

The VARIABLE control, when turned anti-clockwise from the CALibrated position gives up to a six to one reduction in the gain.

- 3.3 HIGH PASS filter switch.

Six position switch gives low frequency roll off points (-3dB) at 0.5, 5, 50, 500Hz and 5kHz plus a d.c. coupled position. Filter slope is 6 or 12 dB/octave.

- 3.4 LOW PASS filter switch.

Five position switch giving low frequency roll off points (-3dB) at 100kHz, 10kHz, 1kHz and 10Hz. Filter slope is 6 or 12dB/octave.

- 3.5 Output OFFSET control.

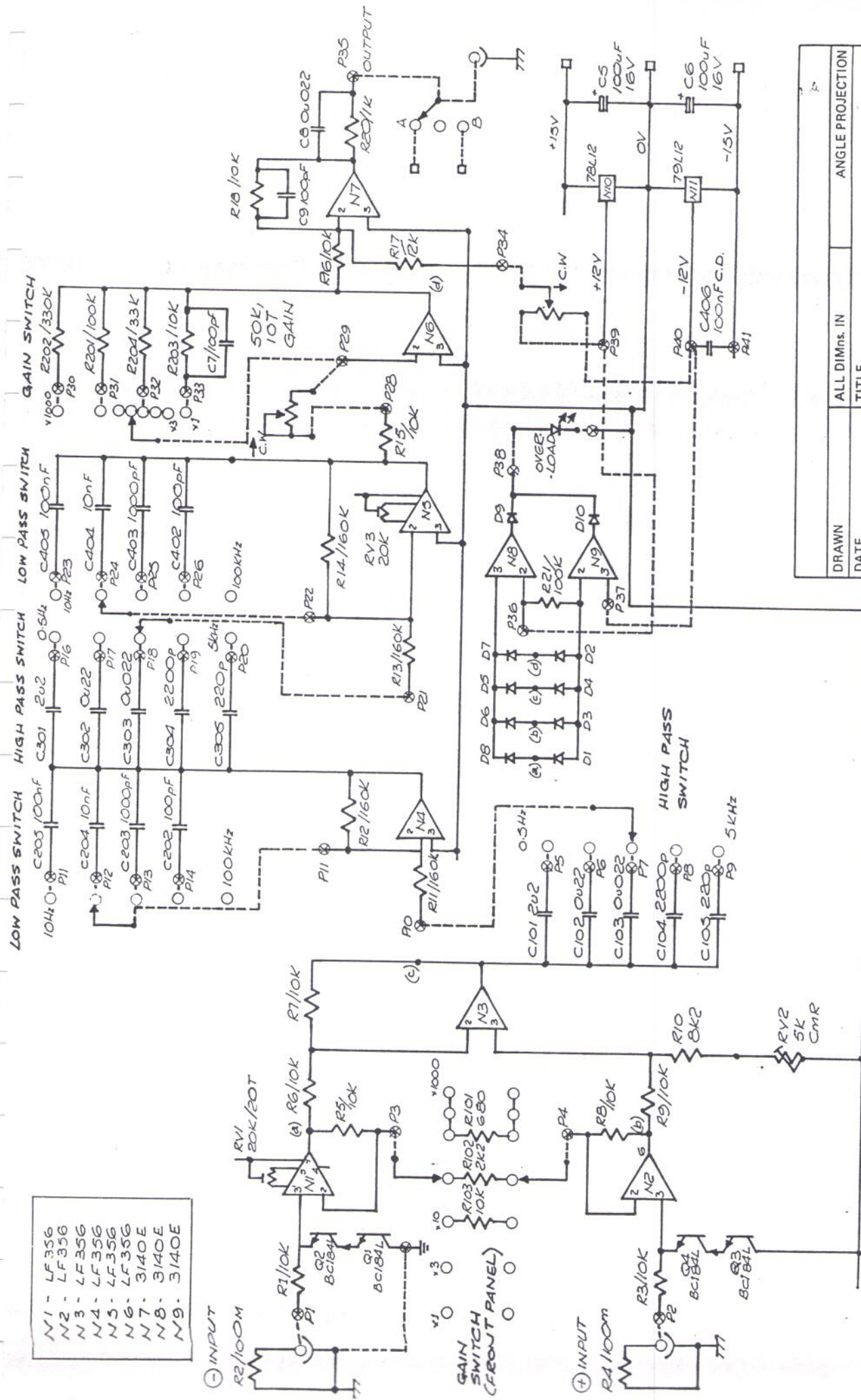
Twenty turn, centre zero screw driven driver potentiometer providing  $\pm 1X$  full scale offset at the output.

3.6 O'LOAD indicator. Red l.e.d.  
Sensing is at the inputs, before the filters and at the amplifier output. Overload may be indicated with no obvious overload at the output in one of three situations:-

- (a) The common mode voltage range ( $\pm 10V$ ) may be exceeded.
- (b) A differential mode, out of range d.c. voltage may have been brought back into output range by the output OFFSET control.
- (c) A differential mode, out of range a.c. voltage may have been brought back into output range by the filters.

3.7 OUTPUT connector and bus selection switch.  
Standard B.N.C. connector and three position toggle switch.

The amplifier output is always available at the B.N.C. connector. Full scale output is 10V from  $1k\Omega$ . The output is protected against the accidental application of excessive voltages. The output may also, by means of the bus selection switch be routed via bus lines A or B to the 217 display module or may be isolated from the bus lines.



- N1 - LF356
- N2 - LF356
- N3 - LF356
- N4 - LF356
- N5 - LF356
- N6 - LF356
- N7 - 3140E
- N8 - 3140E
- N9 - 3140E

DRAWN		ALL DIM'S. IN	ANGLE PROJECTION
DATE		TITLE	
APPROVED		213 CIRCUIT DIAGRAM	
SCALE		SHEET OF	
MATERIAL		DRG. NO.	

