IB-11B034

CONTROL SYSTEMS JANUARY 2000

LFC-XXX

LINEAR FIBER OPTIC BOARD

INSTRUCTION BOOK

INDUSTRIAL INDEXING SYSTEMS, Inc.

Revision - A
Approved By:

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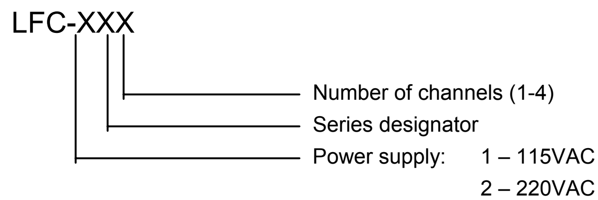
1.0 INTRODUCTION

The LFC-XXX is part of a product line of converters specifically designed to provide a way of bringing some types of system parameters into the master angle bus format.

The system parameter is typically a shaft angle position. The transducer for the shaft angle could be a resolver or an encoder. The RFC-100 and EFC-100 converters have a resolver interface and encoder interface respectively. The LFC-XXX is designed to convert analog voltage into the master angle format. The master angle bus format is then transmitted to the motion controller by a fiber optic cable. This format is used on DeltaMax controllers manufactured by Industrial Indexing Systems.

2.0 IDENTIFYING LFC-XXX CONFIGURATIONS

The LFC-XXX configuration can be identified as follows.



3.0 OPERATION

The analog voltage to fiber optic converter will take a voltage and convert it into a position value to be transmitted on the master angle bus of an DeltaMax Controller via a fiber optic cable. The range of the differential voltage is between +10 volts and -10 volts and within a frequency range between 0 (DC) to 100 Hz.

On power up no transmission will occur for a minimum of 100 milliseconds. When the converter starts converting, transmission of the master angle will start. The master angle is then used by the DeltaMax by locking an axis to the angle bus in various configurations. Action will not take place until the axis controller has been locked. Lock methods are described in the Development System Manual (Refer to IB-11C001).

4.0 INSTALLATION

A. Physical Mounting

1. Location

The LFC-XXX may be mounted up to 100 feet from the Motion Controller. Preferably as close to the analog voltage source as possible but not exceeding 10 feet of analog cable. This arrangement will reduce noise pick up and keep positional variations to a minimum.

2. Position

The orientation of LFC-XXX is not critical but keep in mind the fiber optic cable does have a minimum bend radius of approximately 1.5 inches. The AC power wiring should be dressed away from the analog input wiring.

3. Clearance

Keep at least 5 inches of clearance above the LFC-XXX for proper ventilation for the transformer and voltage regulators.

4. Panel Mounting

The LFC-XXX can be directly mounted to the enclosure backplane using (4) ½” standoffs and appropriate mounting hardware.

B. Cable Interface Connections

Figures 1 & 2 show the various cable configurations to reference when installing the LFC-XXX controller.

4.0 INSTALLATION (cont'd)

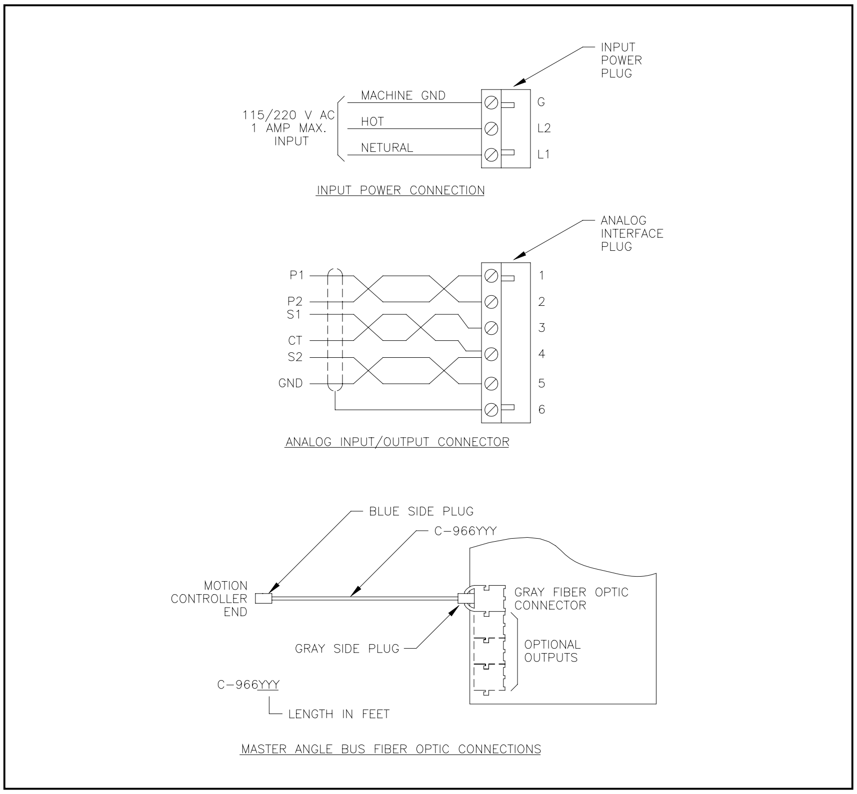
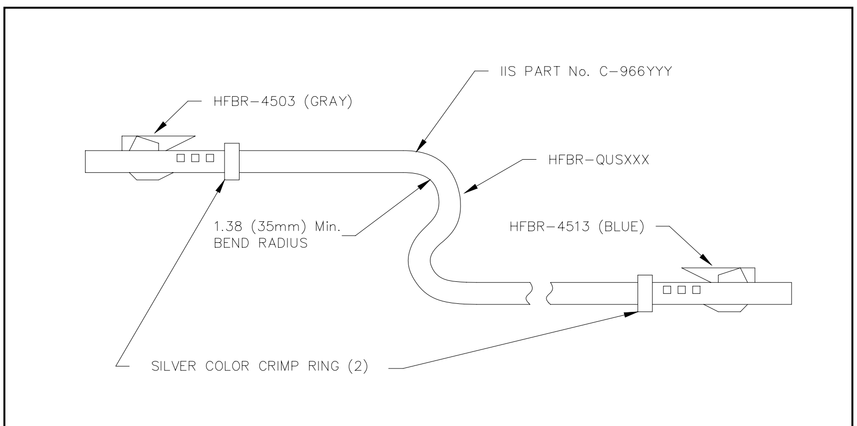


Figure 1



PREMADE CABLES

HEWLETT-PACKARD PART No.	LENGTH (METERS)	IIS PART No.	LENGTH (FEET)
HFBR-QLS001	1	C-966003	3
HFBR-QLS005	5	C-966015	15
HFBR-QLS010	10	C-966030	30
HFBR-QLS020	20	C-966060	60

NOTE: CABLE LENGTH NOT TO EXCEED 100 FT (30M)

MASTER ANGLE BUS FIBER OPTIC LINK CABLE, C-966YYY

Figure 2

5.0 SPECIFICATIONS

A. Analog Input

Differential Input Voltage:	+10 volt -10 volt range
Overvoltage Protection:	max ±40 volts
Maximum Frequency:	100 Hz

B. Voltage Reference

+V Output:	+10 volt buffered 10 mA Max.
-V Output:	-10 volt buffered 10 mA Max.

C. Input Filtering

Hi-frequency Oscillation:	Low pass set @ 3.81 KHz
Impedance Mismatches:	Inductors in each input line
DC Input Bias Currents:	60 KΩ input impedance

D. Power Requirements

Input Voltage:	220/115V AC ± 10%
Frequency:	50-60 Hz
Input Current:	1.0 Amp Maximum

E. Size

Length:	8.50 in. Max.
Width:	5.75 in. Max.
Height:	2.56 in. Ref.

F. Mounting

Panel mount

G. Environment

Operating Temperature:	0 to 60°C
Ventilation:	Unit must have 5 inches of free air flow above
Humidity:	30% to 90% relative (non-condensing)

6.0 CONTROL & INDICATORS

A. Mode Select Switch

The mode select switch is a 16 position rotary switch (SWI), which is used to configure resolution of the analog voltage as it relates to master angle position and allows a selection of test modes to use in the system.

The user may select one of four different resolutions for the ±10 volts range of the input voltage. See **Table 1** for the selections available.

Configuration Switch Settings	Resolver Type			
	Resolution (Bit)	Counts per Voltage Range	Voltage Resolution Millivolts/Count	Description
0	12	4096	4.882	12 Bit Mode
1	14	16384	1.221	14 Bit Mode
2	16	65536	0.305	16 Bit Mode
3*	12	4096	N/A	Test Mode 100 CW
4*	12	4096	N/A	Test Mode 1000 CW
5*	12	4096	N/A	Test Mode 100 CCW
6*	12	4096	N/A	Test Mode 1000 CCW
7	12	4096		
8	12	4096		
9	12	4096		
A	12	4096		
B	12	4096		
C	12	4096		
D	12	4096		
E	12	4096		
F	10	1024	19.53	

Table 1 - Mode Configuration Switch Selections

* Test Modes 3-6 simulate a mechanical shaft turning at the noted speed and direction to simulate Master Position Angle or for Trouble Shooting the system.

CAUTION
HAZARDOUS VOLTAGES ARE PRESENT ON THE UNIT UNDER TEST AND ON THE FIXTURE DURING PORTIONS OF THE FOLLOWING TEST. BE CAREFUL!!!

B. Count Indicators

Three LED indicators provide the status of most significant bit and the two least significant bits of the analog conversion into the angle bus data sent to the motion controller.

6.0 CONTROL & INDICATORS (cont'd)

The most significant bit (MSB) is in actually the sign indication in the data word. The least significant bit (LSB) indicators show the smallest bit resolution status of the data word.

C. Fault Indicator

The fault indicator will show status of the controller. When the fault indicator is on steady, the processor is indicating difficulty in the analog conversion process.

7.0 DIMENSIONS

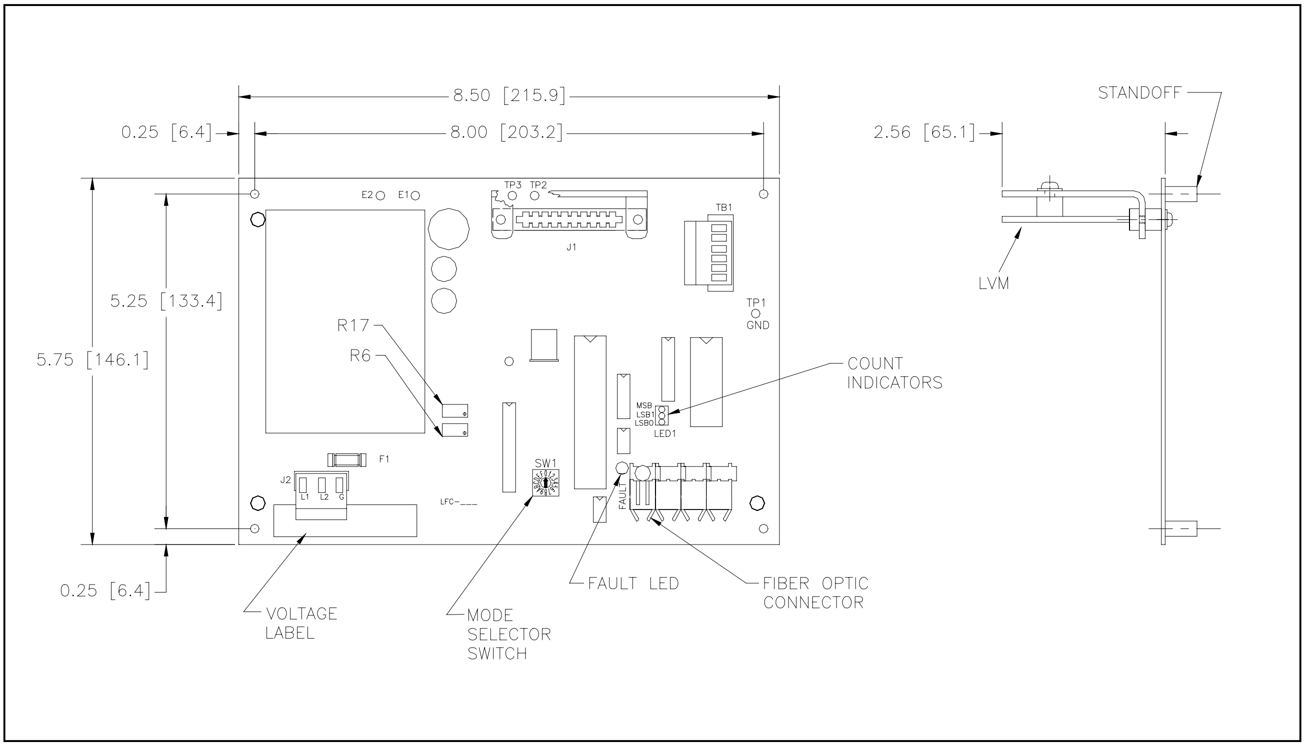


Figure 3

8.0 SETUP INSTRUCTIONS

8.1 PURPOSE

The purpose of this test procedure is to instruct the technician on how to completely test the operation of LFC-XXX mainboard.

8.2 TEST EQUIPMENT REQUIRED

1. Unit Under Test (UUT) LFC electronics.
2. Digital Multimeter (DMM).
3. DeltaMax Controller with fiber optic cable.
4. PC with Serial Communications Cable C-987YYY or equivalent.
5. Adjustable regulated DC power supply.

CAUTION
THE LVM-110 BOARD MUST NOT BE INSTALLED IN J1 WHEN PERFORMING THIS TEST!

8.3 PROCEDURE

1. Connect test equipment as shown in **Figure 2** as follows.

LFC-1XX: 115VAC
LFC-2XX: 220VAC

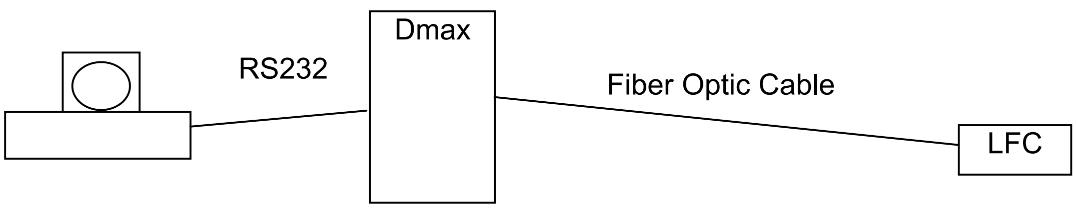


Figure 2

2. Verify that SW1 is in POS 2.

3. Program DMAX to read the fiber optic input.

```
        declare       ON
Count   integer
Loop    get_for_ang   2,1,Count
        goto          Loop
```

4. Download and run the above program on the DMAX.

5. Connect the DMM to the UUT. The positive lead on TP4 (U6-PIN 3) and the negative lead on TP1 (gnd).

6. Adjust R6 such that the DMM reads 2.500 volts.

7. Connect to the DMAX via the Mpro2 analyzer, once connected view the variable integer “Count” as programmed in the DMAX in step 1.

8.3 PROCEDURE (cont'd)

8. Using test clips short together TP2 and TP3.

9. Adjust R17 such that "Count " reads ZERO via the Analyzer.

10. Set an Adjustable Power Supply for 5.00Volts, verify the setting with the DMM.

11. Connect the Adjustable Power Supply to the UUT. Positive terminal is TP3 and negative or ground terminal is TP2.

12. Verify that the "Count" now reads -16384 as viewed by the Analyzer.

13. Program the DeltaMax to read the fiber optic angle speed.

```
                declare_on

speed           integer
loop            get_for_spd         2,1,speed
                goto                loop
```

14. Download the following program to the DeltaMax controller.

15. Verify the rotary switch setting on the LFC-XXX is on pos 3 and cycle power.

16. Connect to the DeltaMax via the analyzer and verify speed variable reads 100.

17. Repeat steps 15 and 16 using switch pos 4-6 and verify speeds 1000, -100, -1000 respectively.

9.0 LVM-110 LVDT VOLTAGE MODULE

The LVM-110 LVDT Voltage Module is a DC-powered LVDT and RVDT signal conditioner board consisting of an oscillator, AC amplifier, demodulator, filter and DC amplifier. Excitation can be either 2.5, 5 or 10 kHz, selected by a plug-in jumper. There are six jumper selectable ranges to match the full range output of the LVDT or RVDT to the full range input of the readout device or PLC analog input module. A board-mounted gain control with a 2.5 to 1 ratio is provided to adjust within a range.

The LVM-110 module is designed for either plug-in connection, to a 10 position PC card edge connector or hard wiring to a 10 point screw terminal barrier strip. It may be rack mounted with card edge guides or stacked by permanently attached threaded standoffs.

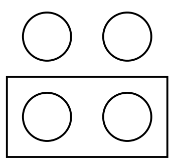
9.0 LVM-110 LVDT VOLTAGE MODULE (cont'd)

The board mounted zero control provides a ±2 volt (±20%) range. Two plug-in jumpers provide a ±4 volt fixed step, thus allowing a total range of ±6 volts or up to 120% zero offset with the board configured for ±5 Vdc full scale. This will allow the board to be set up for a 0 Vdc to 10 Vdc output from minus full scale to plus full scale of the LVDT. Greater than 100% suppression may be useful for fault detection by allowing the zero to be suppressed below the full scale range of the LVDT, thus providing a voltage output throughout the entire linear range of the sensor.

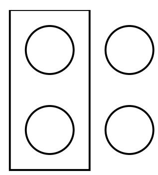
9.1 GAIN SELECTION

Switch S1 controls the first stage gain. One of three gains (X0.4, X1.0 or X4.0) may be selected.

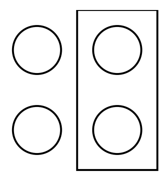
X0.4
Install Jumper
Across Bottom of S1



X1.0
Install Jumper
In Row of S1

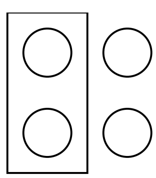


X4.0
Install Jumper
In Row 2 of S1

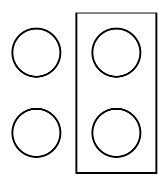


Switch S2 controls the gain of the second stage. Either a high or low gain may be selected.

To Select High Gain
Install Jumper
In Row 1 of S2



To Select Low Gain
Install Jumper
In Row 2 of S2



1st Stage Gain Switch S1	2nd Stage Gain Switch S2	Sensitivity Vrms Input For 10 Vdc Out	Gain
X0.4	Lo	2.1 to 5.56	1.798 to 4.76
	Hi	.994 to 2.64	3.788 to 10.06
X1	Lo	.84 to 2.22	4.5 to 11.9
	Hi	.4 to 1.055	9.47 to 25
X4	Lo	.21 to .556	17.98 to 47.62
	Hi	.0994 to .264	37.88 to 100.6

9.2 CONNECTIONS

Power Connections

15 volts	Pin 5
15 volts	Pin 4
Common	Pin 9

Output Connections

High	Pin 10
Common	Pin 9

	LVDT Connections Color Coded Leads	**Connector Pins**	**LVM-110 Connections**
Pri 1	Brn or Yel/Red	F	Pin 2
Pri 2	Yel or Yel/Blk	E	Pin 3*
Sec 1	Red	A	Pin 6
Sec 2	Blk	D	Pin 8
C/T	Blu/Grn	B & C	Pin 7

NOTE

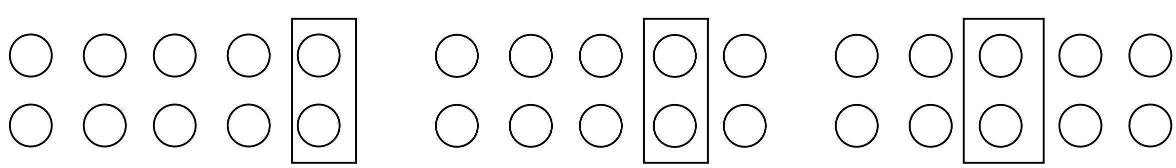
Primary 2 should be hooked to Pin 9 (com) for LVDTs requiring half primary voltage on gain table.

9.3 FREQUENCY SELECT SWITCH

One of the plug-in jumpers, in switch #4 selects the excitation frequency. The other selects the mode (master, slave or stand alone). To select an excitation frequency, install a jumper in one of three positions.

Switch S4

2.5 kHz Row 5 | **5.0 kHz Row 4** | **10 kHz Row 3**



9.4 MULTIPLE LVDT APPLICATIONS

For applications requiring more than one LVDT or RVDT used in close proximity to each other, you should link the oscillators of the LVM-110s. One board is configured to operate as the master, supplying a SYNC signal to the remaining LVM-110s configured as slaves.

9.4.1 Stand-Alone Configuration

The LVM-110 should be configured, for most applications, in the stand-alone mode. This is done by installing a jumper across the top terminals of rows 1 and 2 isolating the oscillator from the SYNC terminal. This is a storage position for the jumper. An excitation frequency must be selected, as shown above, when the board is set up to operate in the stand-alone mode.

9.4.2 Master Configuration

Install a jumper across row 1. The oscillator drives the SYNC terminal with a synchronizing signal. An excitation frequency must be selected for the master a shown above.

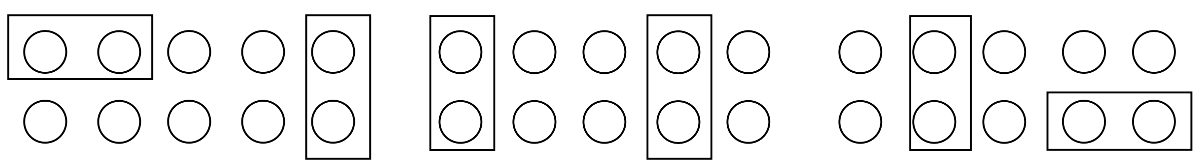
9.4.3 Slave Configuration

Installing a jumper across row 2 will allow the oscillator of the slave to use the SYNC as an input. The SYNC bus must be driven by a master module. SYNC terminals (Pin 1) of all LVMs must be connected for master/slave operation. Do not select an excitation frequency on the slave module. The frequency-select jumper may be stored across the bottom of rows 4 and 5.

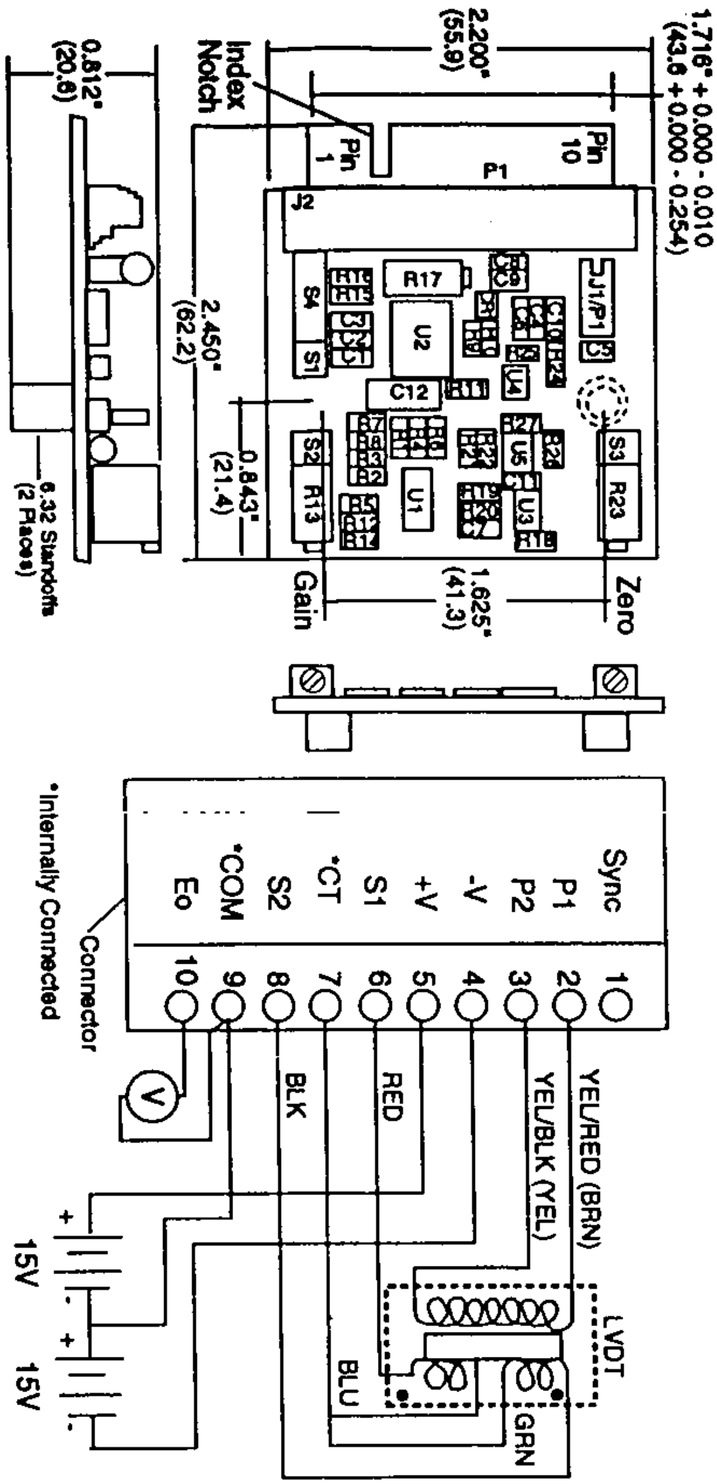
STAND-ALONE
2.5 kHz
Freq. Selected

Master
5.0 kHz
Freq. Selected

Slave
No
Freq. Selected



9.5 DIMENSIONS (mm), MATING CONNECTOR (OPTIONAL)



10.0 RECOMMENDED GAIN SETTING – LVM-110 FOR ±10 Vdc OUTPUT AND ±FS DISPLACEMENT

Frequency	2.5kHz	2.5kHz	2.5kHz	10kHz	2.5kHz	2.5kHz	2.5kHz	2.5kHz	2.5kHz	5kHz	2.5kHz
Transducer Series	HR MP	HPA, GPA HCA, GPA	E	MHR 10kHz	XS-A	XS-C	XS-D	XS-Z, ZT & ZTR	LBB LoSen	LBB STD	M12
± FS											
0.005				NR							
0.010				X4 HI**							
0.020									X4 HI*	X1 HI	
0.025				X4 LO*							
0.040									X4 HI**	X1 HI	
0.050	X1 LO	X.1 HI		X1 HI		X1 HI					
0.100	X1 LO		X.1 HI	X1 LO				NR	X4 LO*	X.4 HI	
0.125		X.1 LO									X1 HI
0.150						X1 LO					
0.200	X.4 HI		X.1 LO							X.4	X1 LO
0.250		X.1 LO		X.4 HI	X4 LO*	X1 LO		NR			
0.300	X1 LO		X.1 LO								
0.400	X1 LO										X1 LO
0.500	X1 LO	X.4 HI	X.1 LO	X.4 HI	X1 LO	X.4 HI		NR			
1.000	X1 LO	X.4 LO	X.4 LO	X1 LO*	X.4 HI	X.4 LO	X4 LO*	NR			
2.000	X1 LO	X.4 HI	X.4 LO		X.4 HI		X1 LO	X4 LO*			X.5 HI
3.000	NR	X.4 HI			X.4 HI		X1 HI*				
4.000	X.4 LO										X.4 LO
5.000	X.4 LO	X.4 LO	X.1 LO		X.4 HI		X.4 LO				
10.000	X.4 LO	X.4 LO	NR				X.4 HI				
25.000							X.4 LO				

* Must be connected for half primary voltage. See connections.

** Must be connected for half primary voltage. See connections also may not get ±10 Vdc adj. for ±5 Vdc.

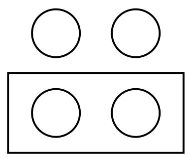
NR Not recommended.

Notes: 2.5 kHz not recommended for MHR Series LVD's. LVM-110 is not recommended for use with XS-B LVD's.

11.0 ZERO SWITCHES

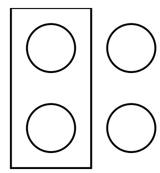
Switch S3 selects the range of the zero control. One of three positions (+ OFF -) may be selected.

To Select -
Install Jumper
Across Bottom of S3



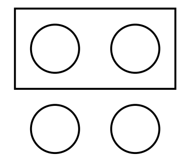
Zero range
-6 to -2 Vdc

To Select OFF
Install Jumper
In Row 1 of S3



Zero range
±2 Vdc

To Select OFF
Install Jumper
In Row 1 of S3



Zero range
+2 to +6 Vdc

12.0 CALIBRATION

Turn unit on, allow 15 minute warm-up. Set frequency and gain plug-in jumper to the correct position for the LVDT being used. Connect LVDT to the LVM-110 except for the Secondary 2 lead, (black lead). Place a temporary jumper from pin 6 to pin 8. Turn the Zero control to obtain an output of 0.0 Vdc. Remove the temporary jumper and connect the black lead to pin 8. Adjust the LVDT core to get as close to zero volts output possible. This is the Null position of the transducer from which the plus and minus displacements are measured.

> **NOTE**
>
> **If this adjustment is mechanically difficult or impractical, approximate the correct position as closely as possible and then turn the Zero control to obtain a zero reading. However, the mechanically zero of the core must be within at least 5% of the rated full scale displacement. Turn the Span control until the output reads the desired full scale voltage, usually ±10 Vdc. If the required full scale reading cannot be obtained by adjusting the Span control, change the gain to the next lower or higher step by changing the jumpers in switches S1 and S2.**

13.0 CALIBRATION WITH 100% ZERO SUPPRESSION

The above calibration procedure will calibrate the instrument for an output of ±10 Vdc for full stroke (-full scale to +full scale) displacement. For some applications, it is desirable to calibrate the instrument to go from zero to +10 Vdc for full stroke displacement. First follow the above calibration procedure but adjust the Span control for half the full scale voltage usually +5 Vdc. You will now have the unit calibrated for ±5 Vdc. Move the core to the -full scale position. The output will be -5 Vdc. Move the jumper in switch S3 from the OFF position to the +position and adjust the zero control for zero volts output. You will now have an output of 0 to ±10 Vdc for full travel displacement.

IB-11B034

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