LVS
Line Voltage Sensor

Instruction Manual

REV C
December 2004

BURK TECHNOLOGY

Introduction

The LVS Line Voltage Sensor permits monitoring of a single phase AC power circuit by providing a DC voltage sample that tracks linearly with the AC input voltage. This DC voltage is approximately $1/125^{th}$ of the AC RMS level, resulting in a low sample voltage that is compatible with most contemporary remote control systems. The LVS features:

- 55 - 480 VAC operating range.
- Linear, low-voltage DC output. DC output representative of $1/125^{th}$ AC RMS line voltage
- Status (ON/OFF) output. Provides a logic signal indicating that the AC voltage on the LVS input terminals is greater than 55 VAC.
- AC Warning LED. Illuminates with as little as 12VAC input. Warns of electrical shock hazard present inside the LVS.
- Internal transient protection. Protects the LVS from electrical disturbances.
- Fused primary circuit (see installation instructions for 480 VAC installations)

Contacting Burk Technology

Sales: 800-255-8090 (Main Office)
800-736-9165 (Kansas City)
sales@burk.com

Support: 978-486-3711
support@burk.com

Visit the Burk Technology web site at www.burk.com for product information, manuals and online support tools.

Installation

CAUTION: Connections to the electrical AC line should only be made by a qualified electrician. Hazardous voltages may be present. Be certain that the installation conforms to your local electrical codes.

1. Mount the LVS on a flat surface close to or inside of the electrical service panel. Be certain to allow access to the fuse holder and the output connector areas of the LVS.
2. To secure the LVS, position 3 mounting screws using the template provided in this document.
3. With the cover of the LVS removed, bring the AC conductors and ground conductor through the cable entry clamp and connect them to the 3-terminal barrier strip. The terminals are labeled from left to right as AC1, GROUND and AC2, where AC1 is the neutral and AC2 is the hot. **USE OF A THIRD WIRE GROUND IS MANDATORY.** Do not rely solely upon the cabinet ground for safety.
4. **For 480 VAC Installations:** The fuse and fuse holder are not rated for use above 250 VAC. For operation above 250VAC, the fuse holder must be removed and an internal connection must be made to connect past the fuse holder. The MOV on the circuit board is intended to operate in 480 VAC applications. External circuit breakers or fuses must be installed ahead of the LVS in all installations.
5. Replace the cover of the LVS after connections have been made.
6. Output connections are made using a 'Combicon' removable terminal block. Pins are numbered from left to right.
   - Pin 1 is the DC Line Sample: 0 - 4.75 VDC representing 0 - 576 VAC.
   - Pins 2, 3 and 4 are connected to ground.
   - Pin 5 is Line Status: an open-collector logic low when the AC line is greater than 55 VAC.

Initial Checkout

1. Remove power from the LVS. Connect the Status signal (pin #5) and one of the ground connections (pin #4) to your monitoring equipment. The Status signal indicates the on or off state of the power line. With power off, the Status output presents an open-circuit or high impedance state.
2. Set up your remote control equipment to indicate an error, fail or OFF condition while the LVS remains powered down. On ARC-16 systems, connect this signal to one of the Status channel input terminals

on the IP-8 Interface Panel. Select the channel on the front display and then press the MODE function until you see the Polarity NORM/INVERT menu. Set this channel for the INVERT condition, and the LED will turn ON when the LVS indicates that the power is turned off or has failed.

3. Connect the Analog signal (pin #1) and one of the ground connections (pin number 2) to the remote control metering input.
4. Apply power to the LVS. The Status will change to a grounded connection, presenting a logic low to indicate that 55 Volts or greater is now detected on the power circuit for which the LVS is sampling. This should be set up to show that power is normal on your remote control equipment.
5. Calibrate the analog metering channel on your remote control while normal working voltage is present on the AC line input of the LVS. The analog voltage from the LVS will provide approximately one volt representing one hundred volts RMS on the power line.

Circuit Operation

NOTE: For device references used in this description, please refer to the LVS schematic.

1. AC power line connections are made to TERMINAL BLOCK **JP1**, bringing the external power through FUSE **F1** to TRANSFORMER **T1** primary and TRANSIENT PROTECTOR **RV1**.
2. TRANSFORMER **T1** steps down the AC input voltage to input filter **R1** and **C1**. Over-voltage protection of the secondary is provided by **D1.** Rectifier **D2** detects and passes the DC voltage to power supply filter **C2.** This is the unregulated internal DC voltage supply.
3. PRECISION REFERENCE **U1** works with RESISTOR **R2** to further regulate to a 2.5 volt DC sample. This value controls the amount of current to RED LED **D3** using **R6**, **R3**, and **Q2**.
4. **R10** offers source current from the unregulated DC supply to the 15 volt ZENER DIODE **D6**. This voltage is amplified through VOLTAGE FOLLOWER **Q3** and presented to FILTER CAPACITORS **C4** and **C3**. This creates a regulated supply voltage which powers DUAL OPERATIONAL AMPLIFER **U2** and protects it from the higher supply voltages that are present when the AC line is 150 VAC or greater.
5. The unregulated DC supply is what the LVS uses as an internal representation of the PEAK AC line voltage. This voltage is scaled using VOLTAGE DIVIDER **R4/R5** and buffered to the OUTPUT CONNECTOR **JP2** using one of the OPERATIONAL AMPLIFIERS of **U2**.
6. VOLTAGE DIVIDER **R8/R9** also takes the unregulated DC supply and compares it to the 2.5 volt DC sample of U1 using the second OPERATIONAL AMPLIFIER of **U2**. This calculates the turn on and off point of the status output using **R13**, **C5** and **D5**. The result of this comparison is presented to OUTPUT TRANSISTOR **Q1** through VOLTAGE DIVIDER **R11** and **R12. D4** provides some protection to OUPUT TRANSISTOR **Q1**, then brought directly to the OUTPUT CONNECTOR **JP1**.

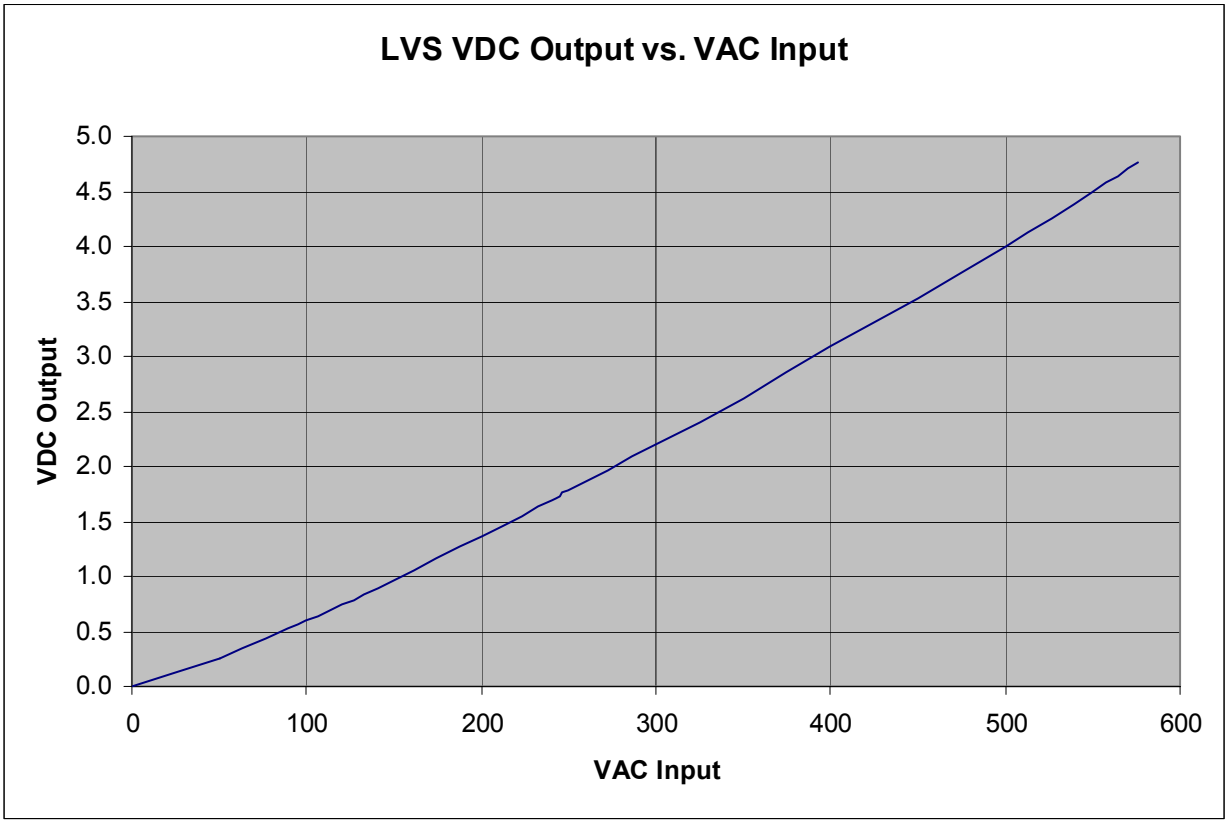
Parts List

LVS Electrical Components Description

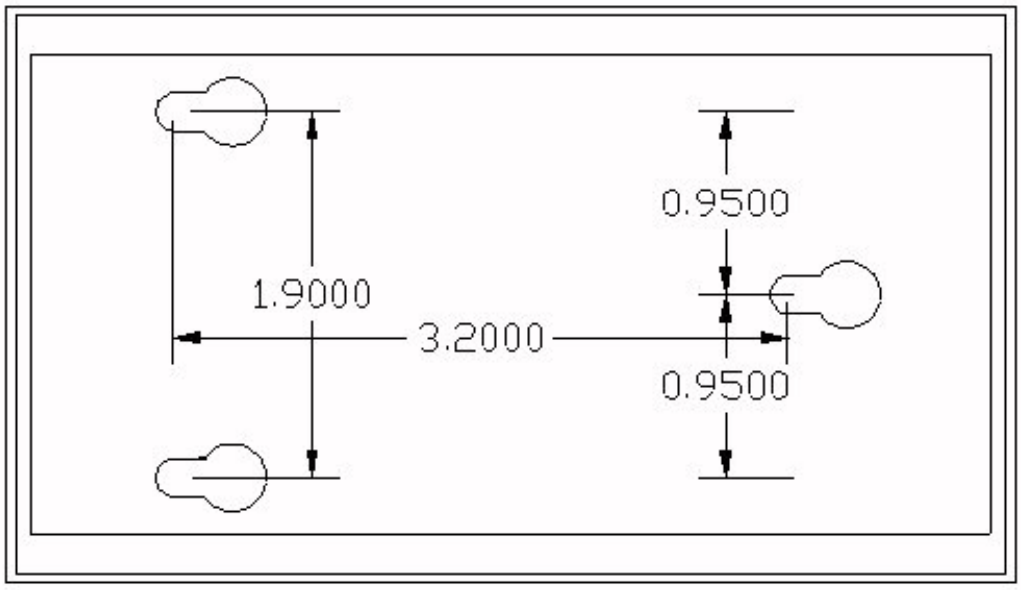
Item	Location	Type of Device	Value / Description
1	C1	Capacitor	.1 µF 1kV
2	C2	Capacitor	100 µF 100V
3	C3,C5	Capacitor	.1 µF
4	C4	Capacitor	10 µF 25VDC
5	D1	Zener Diode	P6KE100
6	D2,D5	Diode	1N4007
7	D3	LED	T1 RED
8	D4	Zener Diode	P6KE30
9	D6	Zener Diode	1N4745
10	F1	Fuse	1A 250V 50mm
11	Q1	Transistor	2N4401 NPN
12	Q2,Q3	Transistor	2N4410 NPN
13	RV1	Transient Absorber	820V
14	R1	Resistor	120Ω 5% 1/4W
15	R5 *	Resistor	6.34kΩ 1% 1/4W
16	R2,R6,R12	Resistor	10kΩ 1% 1/4W
17	R3	Resistor	1kΩ 1% 1/4W
18	R4,R8,R9,R10	Resistor	100kΩ 1% 1/4W
19	R11	Resistor	21kΩ 1% 1/4W
20	R13	Resistor	1MΩ 1% 1/4W
21	T1	Transformer	Signal 14A5
22	U1	Precision Reference	LM385Z
23	U2	IC Dual Op-Amp	LM358

*Note: The LVS comes with a 6.34kΩ 1% ¼W resistor at R5. This allows monitoring of up to 576VAC (480+20%) with up to a 4.75VDC output (see graph). If you are only monitoring 120VAC, then changing R5 to 44.2 kΩ will make the LVS output 4.75VDC at 144VAC (120+20%). If you are only monitoring 240VAC, then changing R5 to 15.5 kΩ will make the LVS output 4.75VDC at 288VAC (240+20%).

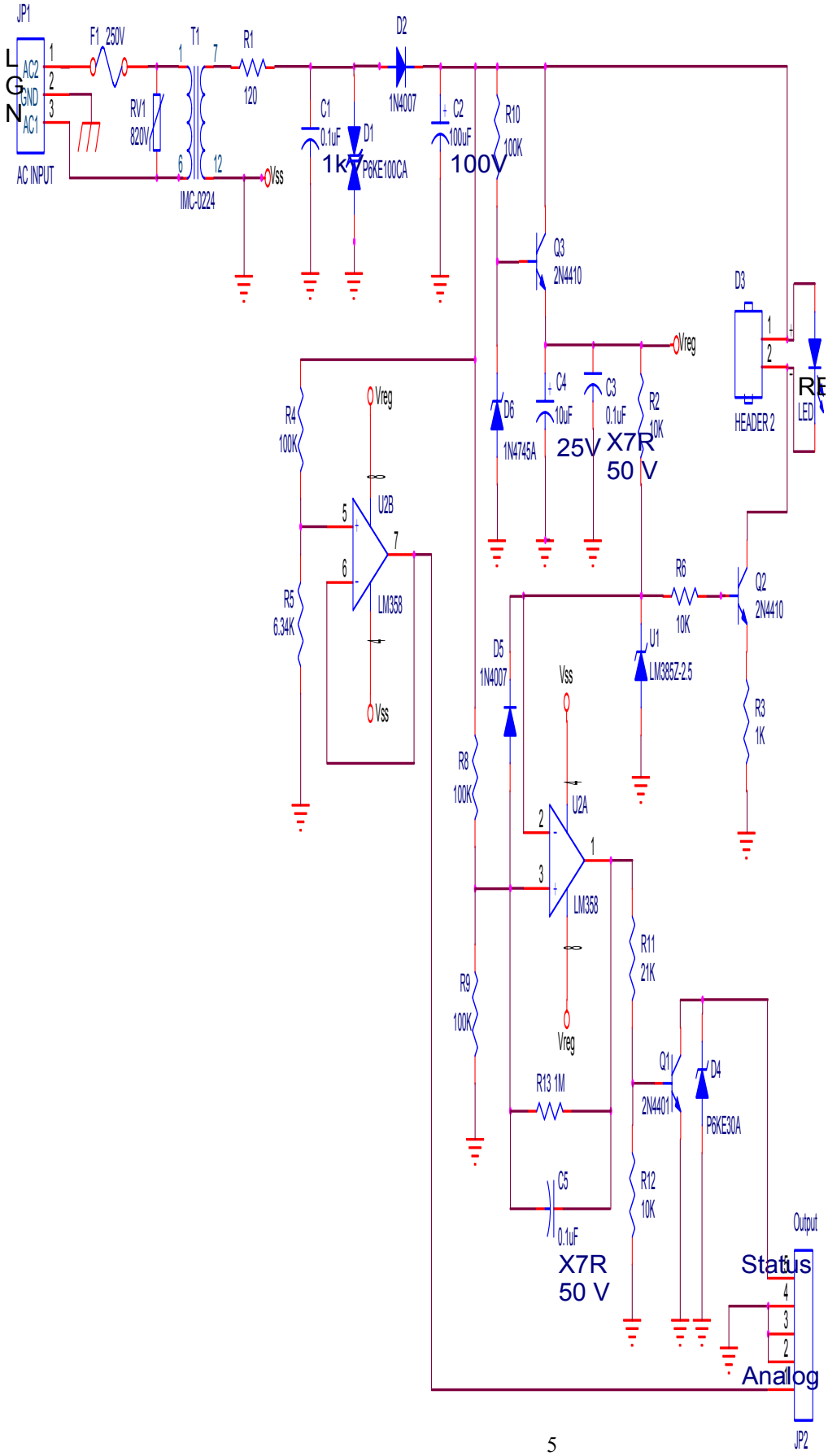
Device Data



Mounting Template



Schematic


JP1
AC2
GND
AC1
AC INPUT
F1 250V
RV1
820V
T1
IMC-0224
R1
120
Vss
C1
0.1uF
1kV
D1
P6KE100CA
D2
1N4007
C2
100uF
100V
R10
100K
Q3
2N4410
Vreg
D3
HEADER 2
LED
C4
10uF
25V
C3
0.1uF
X7R
50 V
R2
10K
D6
1N4745A
R4
100K
U2B
LM358
R5
6.34K
R6
10K
Q2
2N4410
D5
1N4007
U1
LM385Z-2.5
R3
1K
R8
100K
U2A
LM358
R9
100K
R11
21K
R13 1M
C5
0.1uF
X7R
50 V
Q1
2N4401
D4
P6KE30A
R12
10K
Output
Status
Analog
JP2

Warranty

Burk Technology, Inc. warrants the LVS Line Voltage Sensor to be free of defects in materials and workmanship for a period of 24 months from the date of purchase. Equipment will be repaired or replaced at the option of Burk Technology and returned freight prepaid to the customer. Damage due to abuse or improper operation or installation of the equipment or caused by fire or flood or harsh environment is not to be covered by this warranty. Damage in shipping is not the responsibility of Burk Technology. A return authorization must be obtained before returning any equipment. Materials returned under this warranty must be shipped freight prepaid and insured in the original shipping carton or suitable substitute to Burk Technology, 7 Beaver Brook Road, Littleton, MA 01460. Repairs not covered under this warranty will be made at prevailing shop rates established by Burk Technology, Inc.

THE WARRANTY SET FORTH ABOVE IS IN LIEU OF ALL OTHER WARRANTIES, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. BURK TECHNOLOGY, INC. SHALL NOT BE LIABLE TO ANY PARTY FOR ANY INCIDENTAL, SPECIAL, INDIRECT OR CONSEQUENTIAL DAMAGES ARISING FROM THE USE OF THIS EQUIPMENT.