## Service Bulletin № 67



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## Technical Support

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TO:
Parts \& Service Managers
DATE: January 19, 1995
RE:


We have designed our OPTO's to operate as closely to the action of a switch as possible and even more importantly the troubleshooting procedure used to diagnosis a problem is very similiar to that of a mechanical switch.

Switch Test:
Blocking the light beam causes the OPTO to respond like a closed switch, the same as actuating a mechanical switch.

Troubleshooting:
(1) Enter diagnostics; Switch test.
(2) Block beam; does it respond in test? YES = OK NO = CONTINUE
(3) Visually inspect transmitter; is it glowing red? YES $=\mathbf{O K} \quad$ NO $=$ Check 2 pin connector for 5 vdc .

Note: We use Ultra-bright visible red light L.E.D.'s so that no specialized tools are required for troubleshooting. They also have a narrower bandwith when used as a receiver so that ambient light has little to no affect on them, unlike infrared L.E.D.'s which have a wider bandwidth.
(4) Visually inspect the Receiver Bd. for damage or loose connections. Remove the 2-Pin Connector with the green and white wire. Using a jumper wire, short the two wires together. Does the display indicate a switch closure?

$$
\begin{aligned}
& \text { YES }= \text { SUSPECT BAD RECEIVER OR } \\
& \text { REC./XMTR. MISALIGNMENT. } \\
& \text { NO }= \text { SUSPECT OPEN IN SWITCH } \\
& \text { MATRIX WIRING. }
\end{aligned}
$$

Remember, the transmitter is acting as nothing more than a flashlight... if it's on, then it is working. If shorting the Switch Drive / Return lines on the receiver side together indicates a switch closure, then, like a bad microswitch, your Receiver Bd. is bad or misaligned. The cost is approximately the same as a microswitch... only the board is repairable.

# $\frac{5 E A}{\text { Sin }}$ <br> Short-Hop OPTO GaAIAs Ultra-Bright Visible Red Light LED Board. <br> Theory of Operation 

As light from the Transmitter falls on the Receiver LED, it generates a Positive Bias Voltage ( 0.7 v to 1.5 v ) which is applied to the gate of Q1, turning Q1 off. When Q1 is held off, no current flows through Q2's Base, the transistor is off acting as an OPEN SWITCH. When the light is interrupted (BLOCKED) R1 bleeds the gate voltage off of $\mathbf{Q 1}$ allowing it to conduct, switching Q2 on, which acts as a CLOSED SWITCH.

Fig. 1


Note: The RADIO SHACK part number for the LED MT5000UR is 276-087.

## Troubleshooting

 (The following tests indicate normal operating conditions)
## 1. Volt Meter Test:

A. OPEN OPTO (Light Falling on LED) $=$ SWITCH OPEN. Place meter leads across points $\mathbf{A}$ and $\mathbf{B}$ (Refer to Schematic Drawing Fig. 1 above). It should read approximately $0.8-1.2 \mathrm{v}$ DC.
B. CLOSED OPTO (Light Blocked) = SWITCH CLOSED. Place meter leads across points A and B (Refer to Schematic Drawing Fig. 1 above). It should read approximately 0.0-0.1v DC.

## 2. Oscilloscope Test:


A. OPEN OPTO (Light Falling on LED) = SWITCH OPEN. Place Scope lead at Pin-2 of OPTO Rec. Bd. with Scope Grounded. (See Fig. 1). The Scope should display a STEADY +5 v as shown in Fig. 2A, Wave Form Diagram.
B. CLOSED OPTO (Light Blocked) = SWITCH CLOSED. Place Scope lead at Pin-2 of OPTO Rec. Bd. with Scope Grounded. (See Fig. 1). The Scope should display a PULSE STREAM indicating Q2 has switched "On" as shown in Fig. 2B, Wave Form Diagram. This is your Switch Drive Pulse.

## 3. Bench Test (See Fig. 3 Below):

Disconnect the OPTO Transmitter / Receiver Board from the circuit. Connect one side of a $560 \Omega$ Pull-up Resistor to Pin-2 of the OPTO Receiver Bd. and the other side of the resistor to a 5 V DC source. Connect Pin-1 to Ground. Connect a +5 v DC source to Pin-2 of the Transmitter and GND to Pin-1. Align with the Receiver OPTO approximately $3^{\prime \prime}$ distance. Using your Volt-Meter or an Oscilloscope, monitor Pin-2 while BLOCKING and UNBLOCKING the BEAM from the Transmitter. The output will be approximately +5 v DC when the BEAM is not BLOCKED and approximately 0 volts when the BEAM is BLOCKED.

Fig. 3


