HeadMouse®

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APPLICATION DISCLAIMER

The HeadMouse sensor is designed to provide high resolution tracking performance in most environments. However, it should not be used in an application where personal injury or property loss could occur if tracking failed. **Origin Instruments products are *not* authorized for use as surgical aids or as part of a system intended to support or sustain life.** The user assumes full responsibility for determining the suitability of the HeadMouse sensor for the intended application. **Origin Instruments will not be responsible for direct or consequential damages associated with any use of the HeadMouse sensor.**

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Introduction

The *HeadMouse Manual* is a guide to the use and operation of the HeadMouse head controlled pointing device. Before using the HeadMouse sensor please read and study this manual, pay special attention to the hardware description and installation chapters.

Please note, there may be additional documentation shipped with your HeadMouse in the form of hard copy or machine readable addenda.

User Registration

Please complete and return the enclosed user registration form. This will ensure that you receive application software updates following your HeadMouse purchase. In addition you will be on the list to receive follow-on product information and new product announcements. This registration is especially important if your company's ship to address is different than your (user's) first class mail address.

HeadMouse Sensor Warranty

Origin Instruments warrants to the Customer that the products it manufactures will be free from defects in materials and workmanship for a period of one (1) year from the date of shipment. If any such product proves defective during this warranty period Origin Instruments, at its option, will repair the defective product without charge for parts and labor, or will provide a replacement in exchange for the defective product.

In order to obtain service under the foregoing warranties, the Customer must notify Origin Instruments of the defect before the expiration of the warranty period. The Customer shall be responsible for packaging and shipping the defective product, with shipping prepaid, to:

Attn: Customer Service
Origin Instruments Corporation
854 Greenview Drive
Grand Prairie, TX 75050-2438
USA

Telephone: 972-606-8740, FAX: 972-606-8741
email: support@orin.com

Origin Instruments will pay for the return of the product to the Customer if the shipment is to a location within the United States. The Customer will be responsible for paying all shipping charges, duties, taxes, and any other charges for products returned to other locations.

The foregoing warranties will not apply to any defect, failure, or damage caused by improper use, or improper or inadequate maintenance and care. Origin Instruments will not be obligated to furnish service under these warranties (a) to repair damage resulting from attempts by unauthorized personnel to install, repair, or service the product; (b) to repair damage resulting from improper use or connection to incompatible equipment; or (c) to service a product that has been modified or integrated with other products when the effect of such modification or integration increases the time or difficulty of servicing the product.

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Chapter 1, Hardware Description

The HeadMouse is a self-contained optical head tracking sensor. The HeadMouse tracks side-to-side and up-and-down head movements and uses them to directly control the position of the on-screen computer mouse pointer. The HeadMouse works by illuminating and tracking a tiny target that is affixed to the user. The low power eye safe device operates using invisible light energy in the near infrared frequency band.

For the remote input of mouse button "clicks" a wireless infrared (IR) communication link, Remote Switch Interface (RSI), is available. The RSI takes switch closures from normally-open adaptive switches and uses these closures to emulate mouse button "clicks". The RSI Transmitter operates on internal alkaline batteries or an external battery.

The HeadMouse is connected to the host computer using either a standard nine pin serial cable or an Origin Instruments' Smart Cable. The Smart Cables are for conversion of the RS-232 serial port of the HeadMouse to other mouse communication protocols.

This chapter will describe the HeadMouse sensor, the Smart Cables and the Remote Switch Interface communication link.

HeadMouse Sensor

The HeadMouse is an instrument that contains an optical transmitter, an optical receiver and an embedded signal processing computer. The instrument communicates with the host computer over a standard serial port.

Refer to Figure 1, for the following description. The HeadMouse has two optical apertures that must stay free of any debris or obstructions. These two apertures are covered with a special window that is transparent to infrared light and they are subject to damage. For best results and long term sensor operation do not touch the windows and do not clean them unless absolutely required. They should *not* be cleaned as part of a regular maintenance program. If cleaning does become necessary, refer to sensor maintenance in Chapter 5.

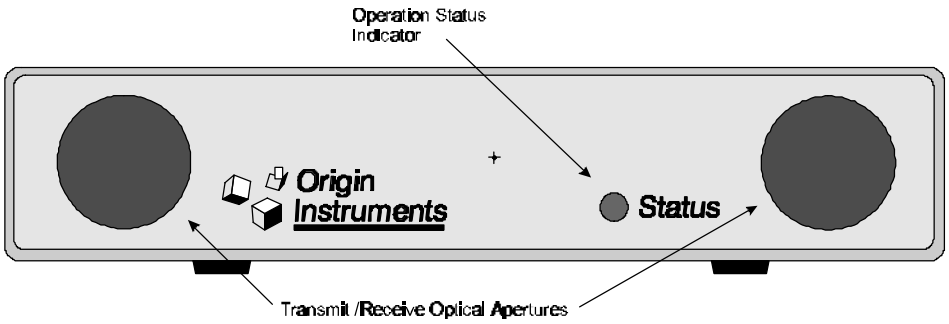


Figure 1. Front view of the HeadMouse Sensor.

During the course of normal operation the HeadMouse can be in one of three states as indicated by the status LED. When a target is not in the HeadMouse sensor's field-of-view or is beyond it's maximum tracking range the HeadMouse will be "Searching" for a valid target. Once a valid target is found the HeadMouse transitions into "Track" mode and begins sending mouse position commands to the computer. If the target exceeds the maximum track range or leaves the field-of-view then the HeadMouse transitions back into "Searching" for a valid target. If a valid target is in track and the target is moved to just at the maximum range or just on the edge of the field-of-view then the HeadMouse will enter a marginal tracking state. The HeadMouse is still tracking the target but the tracking performance will degrade. The HeadMouse indicates these different states to the user by the status LED as described in Table 1.

Table 1. LED tracking status key.

LED Color	HeadMouse Status
Green	Tracking
Yellow	Tracking but conditions are marginal
Red	Searching

The signal I/O connectors, the power connector, and the power switch are located on the HeadMouse sensor's rear panel. The power connector, indicated in Figure 2, is for the wall transformer or power converter shipped with each unit. Application of power to the device is controlled by the main power toggle switch.

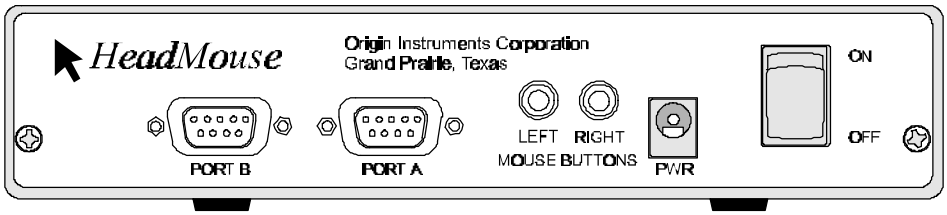


Figure 2. Rear view of the HeadMouse Sensor. PORT A and PORT B are industry standard DB-9 connectors. The MOUSE BUTTON connectors are industry standard 1/8 inch (3.5 mm) microphone jacks. (Apple Macintosh mouse button “clicks” are input through the “LEFT” jack.)

Signal I/O consists of two EIA RS-232C ports using DB-9 connectors and two switch inputs using 1/8 inch (3.5mm) microphone jacks. The microphone jacks are used to input the “LEFT” and “RIGHT” mouse buttons. Apple Macintosh mouse button “clicks” are input through the “LEFT” jack. The connectors are wired so that the “LEFT” and “RIGHT” normally open switch contacts are on the “TIP” and switch common is on the “SLEEVE”. Figure 3 illustrates how the mating 1/8 inch (3.5mm) microphone plug should be wired. The mouse button connectors on the rear of the HeadMouse will provide inputs for two buttons. (The Remote Switch Interface communication link will accommodate three buttons.) A function table and pin out of the two DB-9 connectors is contained in Figure 8.

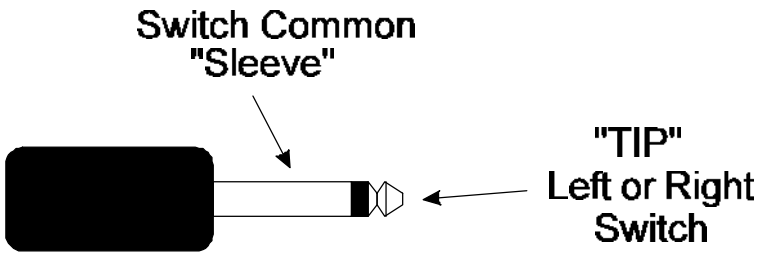
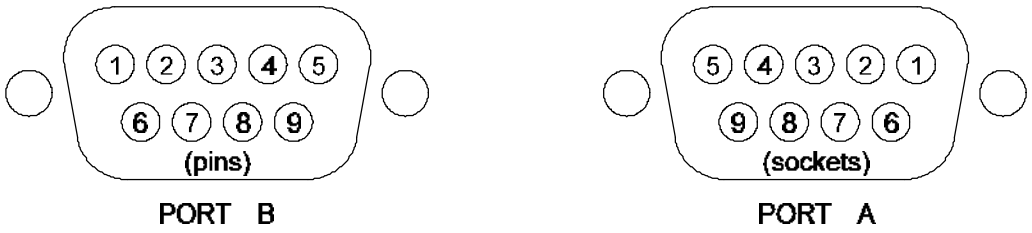


Figure 3. 1/8 inch (3.5mm) mono microphone connector.



Pin	PORT B		PORT A	
	Function	Relative to HeadMouse	Function	Relative to HeadMouse
1	No Connect		No Connect	
2	RXDB	input	TXDA	output
3	TXDB	output	RXDA	input
4	+12 VDC*	output	No Connect	
5	Ground		Ground	
6	No Connect		RTSA†	output
7	RTSB	output	CTSA	input
8	CTSB	input	RTSA†	output
9	No Connect		No Connect	

* Maximum current draw is 20 milliamps.
† These pins are connected in parallel.

Figure 4. Function and pin outs of the HeadMouse EIA RS-232C ports. PORT A connects to the host computer and PORT B connects to either the RSI Receiver or a standard Microsoft compatible desktop mouse.

Smart Computer Interface Cables

To convert the standard RS-232 signal format of the HeadMouse to a communication format used by other computers, Origin Instruments has developed a series of Smart Cables. Presently cables are available for Apple Macintosh computers and for computers that use the IBM PS/2 mouse format. These Smart Cables have two microprocessors embedded in one of the connector back shells to convert HeadMouse information to the appropriate format. The cables are completely interchangeable so that one HeadMouse sensor can be used with different computers. All that is required is a simple change of the host interface cable.

These cables are powered by the host computer and are completely transparent to the HeadMouse, the host computer, and the application software. However, because the cables contain electronics within the connector back shell the cable should not be immersed or soaked as part of a cleaning process. If the cable does become soaked it should be allowed to dry completely, inside and out, before use.

If the host computer uses a standard RS-232 serial port for a desktop mouse then only a standard DB9M to DB9, or DB25 (or whatever connector is used by your computer for the desktop mouse) cable is required.

Remote Switch Interface (RSI) Infrared Communication Link

For the wireless transfer of mouse button “clicks” a Remote Switch Interface (RSI) is available. The RSI uses infrared energy to transfer the state of up to three normally-open switches to the HeadMouse. These switch states are used to emulate the “LEFT”, “RIGHT”, and “MIDDLE” buttons of a standard desktop mouse. When emulating the Apple Macintosh mouse, the HeadMouse uses “LEFT” switch closures as mouse button clicks. The RSI transmitter has two 1/8 inch (3.5mm) microphone jacks and can accept commonly available adaptive switches. An illustration of the transmitter's rear panel is shown in Figure 5.

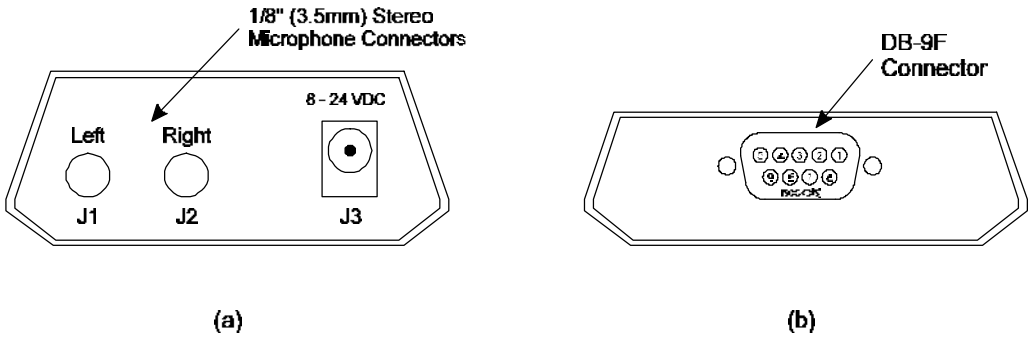


Figure 5 Rear view of (a) the infrared transmitter and (b) the infrared receiver.

The 1/8 inch (3.5mm) microphone jacks are stereo connectors and by changing a jumper, internal to the transmitter, the transmitter can be configured to accept mono or stereo plugs (factory default is for mono plugs). Therefore, the transmitter can accept standard mono plugs for the “LEFT” and “RIGHT” mouse buttons or can accept stereo plugs and also provide the “MIDDLE” mouse button. Configuring the transmitter for the “STEREO” mode also allows the use of a two position switch with one 1/8 inch (3.5mm) stereo microphone plug. Table 2, describes the function of the connector jacks for both modes and Figure 7 illustrates the jumper position on the transmitter printed circuit board.

Please note that if a mono plug is used with the transmitter in the “STEREO” mode that the “ring” connection of the connector will be shorted to the “sleeve”. This will cause the transmitter to continuously send the “RIGHT” mouse button command. Not only will this continuos “RIGHT” button command cause erratic computer behavior, it will also rapidly deplete the transmitter batteries. *Therefore DO NOT use mono plugs when the transmitter is in the “STEREO” operating mode.*

Table 2. Remote Switch Interface (RSI) Transmitter programming options. The “STEREO” option allows three mouse buttons to be emulated or the use of a two position switch with one stereo plug.

Jumper Position	Mode	Jack	Connection	Description
1 to 2*	MONO	J1	TIP	“LEFT”†
		J1	RING	No Connection
		J2	TIP	“RIGHT”
		J2	RING	No Connection
2 to 3	STEREO	J1	TIP	“LEFT”†
		J1	RING	“RIGHT”
		J2	TIP	“MIDDLE”
		J2	RING	No Connection

(SLEEVE on both jacks is switch common.)
* - Factory Default Setting
† - Apple Macintosh Mouse Button

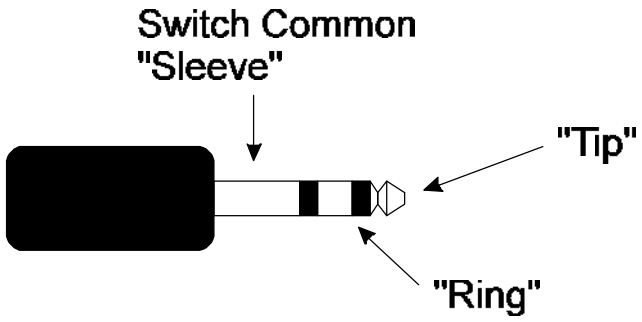


Figure 6. 1/8 inch (3.5mm) stereo microphone connector.

The transmitter has a built in feature to guard against accidentally leaving a switch actuated for long periods of time and depleting the batteries. If one or more switches is left actuated for longer than two minutes the transmitter will stop all transmissions until any connected switch changes state.

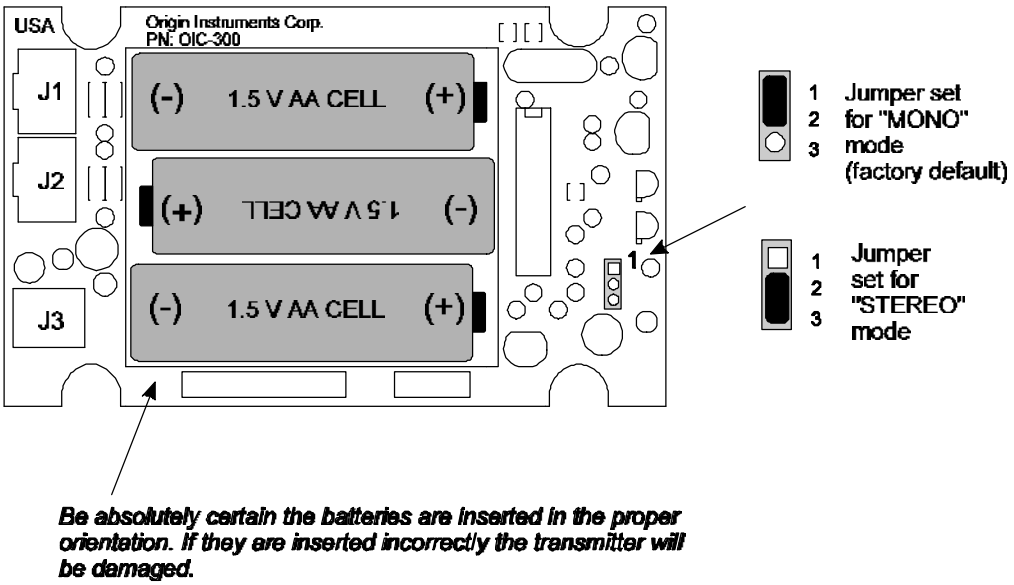


Figure 7. Inside the Remote Switch Interface (RSI) Transmitter. The mode selection jumper is illustrated along with the appropriate positions for “MONO” and “STEREO” modes. Also note proper orientation for the three 1.5 V AA-Size alkaline batteries.

The transmitter is normally powered using three internal AA-size alkaline batteries. When the switches connected to the transmitter are not actuated the transmitter is asleep and essentially uses zero battery power. A typical user will see battery lifetimes of several months. However, battery life is dependent on usage and some users may see substantially longer or shorter battery lifetimes.

The transmitter can also be powered by connection to an external 8 to 24 volt DC power source. The external power input is specifically designed for direct connection to a 12- or 24-volt battery. Figure 8 illustrates the proper polarity and size of the mating power plug.

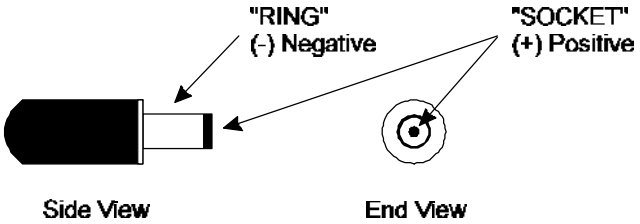


Figure 8 Mating power connector for the Remote Switch Interface (RSI) transmitter. Mating center conductor is 0.08 inch (2.1mm) in diameter and the outside ring diameter is 0.21 inch (5.5mm).

Chapter 2, Installation

Electromagnetic Interference Considerations

Origin Instruments Corporation of 854 Greenview Drive, Grand Prairie, Texas 75050, USA declares under our sole responsibility that the HeadMouse to which this declaration relates is in conformity with the following standards or other normative documents and following the provisions of the Electromatic Compatability Directive, 89/336/EEC

EN 55022 (w/ Amendment 1), Class B, Limits and methods of measurement of radio interference characteristics of information technology equipment, 1995.

EN 50082-1, Electromagnetic compatability – Generic immunity standard – Part 1: Residential, commercial, and light industry, January 1992.

Origin Instruments Corporation has tested the HeadMouse and found that it complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

If the HeadMouse is suspected of causing interference to a radio or television receiver, cycle it's power on and off to determine whether it is the cause of the disturbance. If a problem exists, the user is encouraged to try and correct the problem by one of the following measures:

1. Reorient the antenna of the affected receiver.
2. Relocate the equipment with respect to the receiver.
3. Move the equipment away from the receiver.
4. Plug the equipment into a different AC outlet so that the equipment and receiver are on different branch circuits.
5. Ensure that the equipment data cables and cover are properly installed and tight.
6. Reorient the equipment cables.
7. Consult Origin Instruments for additional suggestions.

Origin Instruments is not responsible for any problems caused by unauthorized modification of this equipment.

Set-up

Installation of the HeadMouse primarily involves replacing the desktop mouse with the HeadMouse. The HeadMouse is simply connected to the computer and after the application of power the HeadMouse begins emulating a standard Microsoft, Apple Macintosh, or IBM PS/2 desktop mouse.

For communicating mouse information to an IBM PC or compatible the HeadMouse sensor is connected to the computer's standard serial port (EIA RS-232). In addition, the host must also have a mouse driver program installed to interface the HeadMouse to the application program.

For communicating with Apple Macintosh computers, Origin Instruments provides a special Smart Cable that adapts the HeadMouse serial port to the Apple Macintosh. The standard Apple Macintosh desktop mouse is simply replaced with a HeadMouse using the Smart Cable for the Apple Macintosh.

Origin Instruments also provides a Smart Cable for computers that use the IBM PS/2 compatible desktop mouse. Therefore, by changing one cable the HeadMouse can be used with IBM PC compatibles, Apple Macintosh computers, and a variety of other computer workstations from several manufacturers. These special cables employ embedded electronics in the connector back shell for converting the HeadMouse serial data format to the other formats.

HeadMouse power is provided by the supplied power converter or wall transformer which is connected to the AC mains. For transferring mouse information from the HeadMouse to the host computer a cable (or Smart Cable) is connected to PORT A. These connections are made to the HeadMouse rear panel connectors illustrated in Figure 2.

The HeadMouse operates in either the "Standard" or "Teach" mode. In both of these operating modes connections to the computer and to AC power are identical. Differences of the remaining connections are associated with how adaptive switches, if any, are input to the HeadMouse. Please refer to Chapter 3 for a discussion of the two HeadMouse operating modes. Also, please note that at the application of power the HeadMouse will automatically enter the "Teach" mode when a Microsoft compatible desktop mouse is connected to "PORT B". If an RSI receiver is connected, or if nothing is connected to "PORT B" then the HeadMouse will enter the "Standard" mode. Again, the HeadMouse determines which mode to operate in at the application of power; therefore, always cycle the HeadMouse power switch after changing the connections for a different operating mode.

For the "Standard" operating mode attach the Remote Switch Interface (RSI) receiver to "PORT B" with the supplied cable, see Figure 9. The adaptive switch or switches are connected to the infrared transmitter. A switch or switches may also be simultaneously connected to the rear panel connectors of the HeadMouse. However, switches

connected directly to the HeadMouse and switches connected to the infrared transmitter control the same mouse buttons.

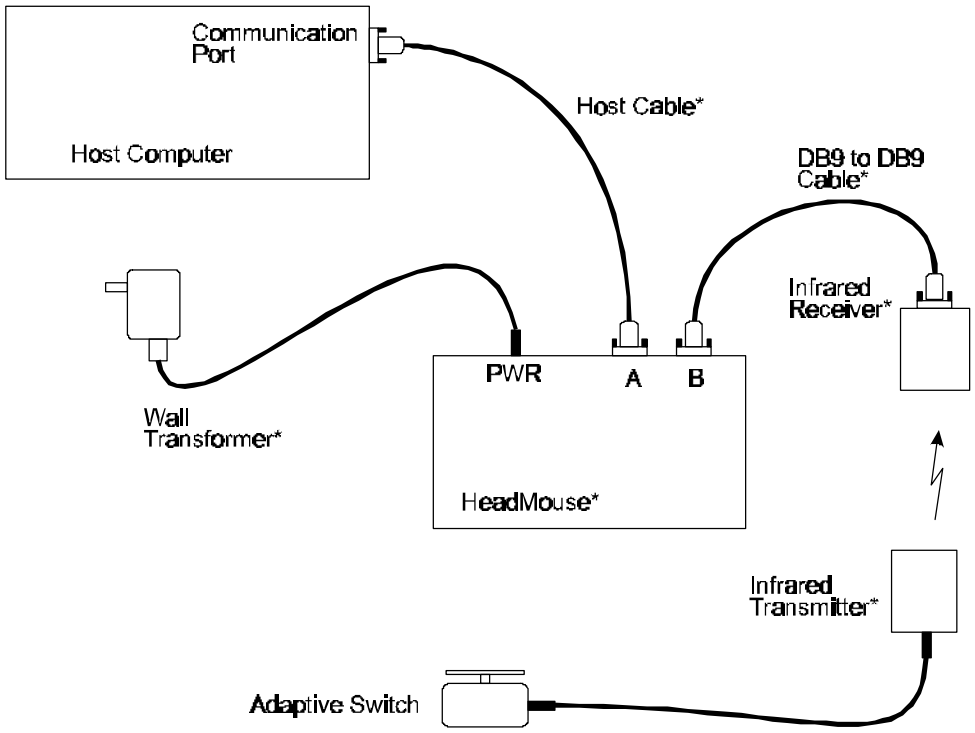


Figure 9 HeadMouse connected to a computer and set up for the “Standard” operating mode. Asterisk indicates equipment supplied by Origin Instruments.

For operation in the “Teach” mode a Microsoft compatible desktop mouse is connected to “PORT B” instead of the infrared receiver. The adaptive switch or switches are then connected to the HeadMouse rear panel connectors, see Figure 10. The remaining connections are the same as for the “Standard” mode.

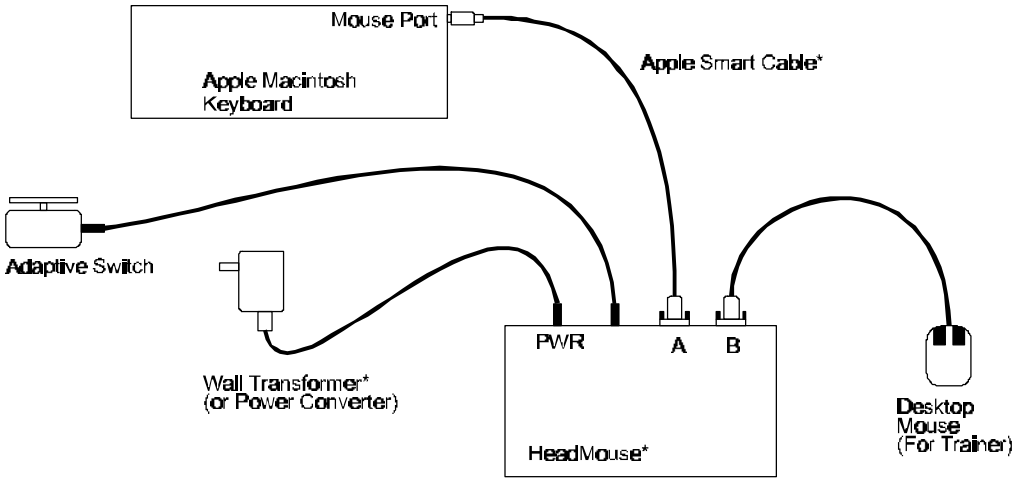


Figure 10 HeadMouse connected to a computer and set up for the “Teach” operating mode. Asterisk indicates equipment supplied by Origin Instruments.

HeadMouse Placement

Figure 11 illustrates how the HeadMouse is positioned on the computer display. The HeadMouse is placed on top of the workstation display with the sensor’s front plate aligned with the display’s CRT screen. The sensor placement should be such that its field-of-view is approximately centered on the viewer’s nominal head position. It is also very important that the sensor be positioned such that its front panel is approximately even with the front edge of the monitor. This will eliminate self induced interference associated with reflections from the monitor’s top surface.

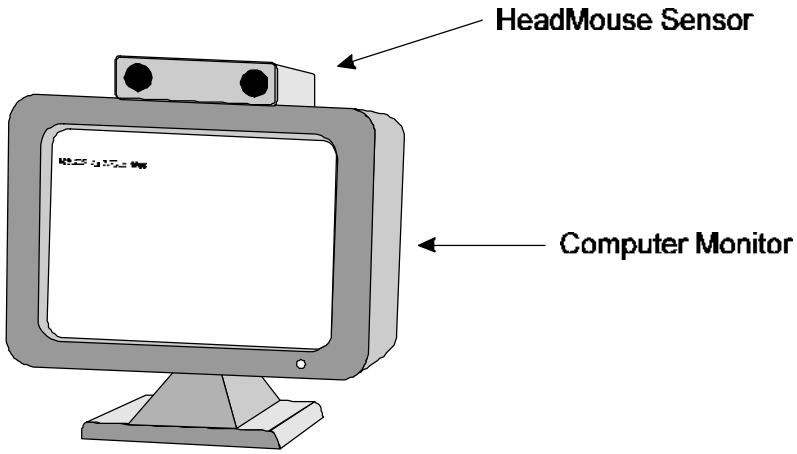


Figure 11. Typical HeadMouse installation.

Suitable Environments

The HeadMouse operates using near infrared light energy; therefore, situations where bright sources of infrared light are within the field of view of the HeadMouse or which directly illuminate the user should be avoided. This does not mean that the HeadMouse will not operate correctly while in one or both of these situations, but that HeadMouse performance may degrade. The two most common sources of near infrared light are the sun and incandescent lamps. Light sources based on fluorescent lamps do not radiate a significant amount of near infrared light and therefore pose no interference problem.

Highly reflective objects placed adjacent to the HeadMouse target dot should also be avoided. In most cases there will be no problems associated with these objects (clutter) unless they are placed in the immediate vicinity of the target. Some who wear eyeglasses may also have problems with spurious reflections off the lenses or metal frame. These problems are best handled by moving the target away from the eyeglasses frame, or providing a diffuse mask behind the target. Spurious reflections from jewelry are usually not a problem because these objects are typically located some distance away from the target. As a final resort to dealing with interference problems, the interfering objects, where feasible, should be removed from the immediate area.

Multiple sensors may be used in the same neighborhood as long as the sensors do not radiate *directly* into each other's field-of-view. If the sensors are facing each other and are closer than about 30 feet there will probably be interference. However, multiple sensors can have overlapping fields-of-view as long as one sensor does not radiate directly into the receiver of another one. For instance, an installation could be set up such that two sensors are positioned on adjacent computer systems. As long as the

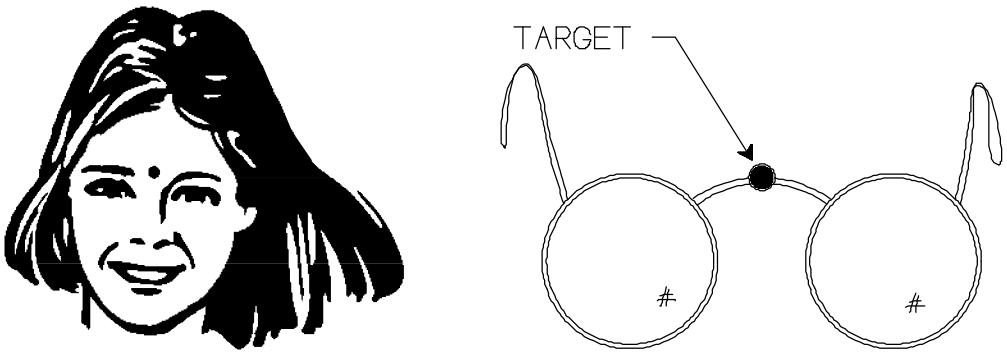
sensors were oriented so that neither radiated directly into the receiver of the other, both would operate as if the other were not there.

Another potential interference source is self induced and is almost always associated with reflections from objects very close to the HeadMouse. The most common object encountered is the top of the CRT monitor. This problem shows up when the HeadMouse is improperly positioned back from the front edge of the monitor. In this position, the monitor's front ledge is in the HeadMouse sensor's field-of-view and because it is so close the transmitted energy is reflected back at very high power levels. This will not damage the sensor; however, it will often prevent it from operating properly. Another situation that can cause self induced interference occurs when the sensor's front panel is oriented approximately parallel to a highly reflective and flat surface (e.g. mirror or plate glass).

Finally, objects that obscure the HeadMouse sensor's line-of-sight to the target dot must be controlled. Items that typically interfere with the sensor's line-of-sight are: people, parts of the user's body especially hair, hats, wiring, HeadMouse mounting fixtures, and furniture.

Target Dot Placement

To cue the sensor, a paper thin and disposable target dot is placed on the user's forehead or eyeglasses. Figure 12(a) shows the tiny target dot attached to the forehead while (b) shows a tiny target dot attached to standard eyeglasses.



(a) (b)

Figure 12. Typical target dot installation for head tracking: (a) target attached to the forehead (b) target attached to eyeglasses.

During operation the HeadMouse must maintain a clear line-of-sight to the target dot. The user is referred to the discussion about suitable environments for more information regarding line-of-sight issues.

Chapter 3, Operation

In general the HeadMouse operates in the following manner. Immediately after the application of power the sensor initializes itself, transitions into the search mode and begins looking for a target. The typical time required to acquire a valid target is 0.3 sec. If no target is in the field of view the sensor will continually search until one is acquired or until the power is turned off.

The HeadMouse responds to external inputs in a manner very similar to a standard desktop mouse. When the HeadMouse is not tracking a target dot or the target dot is stationary the HeadMouse does not send mouse information to the host computer. In other words, if the target dot (the user's head) does not move the on screen mouse pointer does not move.

Mouse button inputs can be entered by using either the 1/8 inch (3.5mm) microphone jacks on the HeadMouse rear panel or using the 1/8 inch (3.5mm) microphone jacks on the remote switch interface. See Chapter 1, for a description of the hardware and Chapter 2, for installation instructions.

The base HeadMouse emulates a standard Microsoft compatible desktop mouse as extended by Logitech for the addition of a third button. This extension is provided so that a third button can be accessed for those applications that require it (typically, Computer Aided Design (CAD) programs).

The HeadMouse and Smart Cables will indicate which host computer port they are connected to by responding to the inquires from standard mouse driver software. Upon receiving these responses, which are the same as from a desktop mouse, the mouse driver software is loaded on the host computer. *However, the HeadMouse must be powered-up and properly connected for an appropriate response to take place*. After proper installation, the information received by the host computer from the HeadMouse will be indistinguishable from that received from a desktop mouse.

Operating Modes

The HeadMouse has two operating modes available to the user and they are listed in Table 3.

Table 3. HeadMouse Operating Modes.

Mode Number	Operating Mode
0	Standard
1	Teach

(HeadMouse automatically determines mode type at the application of power)

The operating mode is automatically selected by the HeadMouse based on the external connection to “PORT B”. When a standard Microsoft compatible desktop mouse is connected to “PORT B” the HeadMouse takes this as an indication to enter the “Teach” mode at power-up. When a desktop mouse is not connected to “PORT B” the HeadMouse will default to the “Standard” mode at power-up. Therefore, when the RSI Receiver is connected to “PORT B” the HeadMouse will enter the “Standard” mode at power-up.

Many computers do not load the mouse driver software if a mouse is not attached to the appropriate port at boot time. If the HeadMouse is connected to the proper port, with power applied, it will cue the computer to load the mouse driver. When the HeadMouse is queried by the mouse driver and a Smart Cable is not attached, the HeadMouse also checks to see if a Microsoft compatible desktop mouse is connected to “PORT B” and if so, the HeadMouse enters the “Teach” operating mode.

Because the HeadMouse emulates a standard desktop mouse and uses the same mouse driver software, the host computer and mouse driver operate exactly the same as if a standard desktop mouse were in use. The fact that a HeadMouse is connected to the computer is transparent to both the application software and the computer.

Standard Mode: The HeadMouse or HeadMouse and Smart Cable provides direct, head-controlled mouse emulation using a data format compatible with the desktop mouse it replaces. The HeadMouse sends out mouse data packets in direct proportion to target movements in azimuth and elevation. Switch closures input to the HeadMouse rear panel connectors or Remote Switch Interface are used to emulate a press of the left, right and middle mouse buttons. The Apple Macintosh mouse button is input to the HeadMouse as the left button. The RSI Receiver is connected to the HeadMouse “PORT B” connector (see Figure 9).

Teach Mode: The HeadMouse or HeadMouse and Smart Cable provides direct, head-controlled mouse emulation using a data format compatible with the desktop mouse it replaces. The HeadMouse sends out mouse data packets in direct proportion to target movements in azimuth and elevation. Switch closures input to the HeadMouse rear panel connectors or Remote Switch Interface are used to emulate a press of the left, right and middle mouse buttons. The Apple Macintosh mouse button is input to the HeadMouse as the left button.

In addition to head control of the on-screen mouse pointer the HeadMouse can operate in conjunction with a desktop mouse. To facilitate this functionality the HeadMouse has the capability to

accept desktop mouse data and transmit it to the computer instead of data derived from head movements. The main advantages of this architecture are that only one connection is required to the computer and only one standard mouse driver is installed on the computer. The desktop mouse is connected directly to the HeadMouse “PORT B” as illustrated in Figure 10.

Multiple Apple Macintosh compatible mice can be connected to the ADB bus simultaneously; however, the HeadMouse should be the only mouse connected directly to the bus. The reason for this is all mice connected to the bus have additive control over the on-screen mouse pointer. Since the HeadMouse user cannot typically hold his head perfectly still a traditional mouse user will be constantly fighting the HeadMouse to maintain the position of the mouse pointer. This effectively renders the additional mouse unusable.

However, the solution is to use a desktop mouse that is filtered through the HeadMouse. Now the HeadMouse can manage the on-screen mouse pointer by allowing either the desktop mouse or the HeadMouse to control its on-screen position. Using this control model, during most times the HeadMouse will have control of the on-screen pointer. Only when the desktop mouse changes state does control of the pointer transfer to the desktop mouse. After the desktop mouse is idle for a duration of approximately one second, control will revert back to the HeadMouse. A change of state is defined as mouse movement or a mouse button actuation.

This mode is specifically designed to allow a desktop mouse user to instruct or collaborate with a person using the HeadMouse and the same computer system and application software.

Chapter 4, Problem Solving

The HeadMouse sensor is a permanently aligned and factory calibrated optical radar. The sensor does not require user alignment or calibration for proper operation.

In the questions and answers that follow several issues associated with operation of the HeadMouse are discussed.

Frequently Asked Questions:

Q: Why does the status light indicate the HeadMouse is tracking when there is no target in the sensor's Field-Of-View (FOV)?

A: There are several possibilities:

1. There really is a target in the sensor's FOV, maybe one inadvertently stuck to something in your work area.
2. There is a mirror (or window) in the sensor's FOV oriented approximately parallel to the HeadMouse sensor's front panel. The transmitted light is being reflected directly back into one of the receivers.
3. There is some reflective and concave item in the sensor's FOV.
4. There is a *very* bright infrared source within the sensor's FOV. This is unlikely because the sensor can reject all but the most intense infrared sources.
5. There is an object *very* close to, and in the field-of-view of, the HeadMouse sensor's transceivers. This object is reflecting transmitted light back into the receiver at a very high level and causing interference. This reflected light will not harm the sensor; however, it may impair its proper operation. Often this problem is associated with misplacement of the sensor on the CRT monitor. Typically the misplaced sensor is positioned so that the top ledge of the monitor case is in the sensor's field-of-view. These near field reflections then cause self induced interference. To correct this problem, position the HeadMouse so that its front panel is approximately even with the monitor's front edge.

Q: Why does the status light sometimes change from red to green and back to red when an un-targeted object transits the sensor's FOV?

A: By passing through the sensor's FOV the object has masked and unmasked an infrared source and the HeadMouse momentarily investigated to see if the source was clutter or a valid target. The sensor is constantly searching for valid targets whenever it isn't tracking. It sometimes will momentarily transition into track mode on a piece of clutter until it has had more time to investigate the validity of the source.

Q: Do the targets wear out?

A: Yes, with repeated handling (rubbing, deposition of debris, and application and removal) the efficiency of the targets will degrade. Replacement targets are available at a nominal charge from Origin Instruments. However, a target is usually worn for several days before it is changed.

Q: Can I sleep or bathe while wearing a target?

A: Yes, people should continue their regular sleeping and personal hygiene practices. After several days the target will degrade and at that time it should be replaced.

Q: What happens when the HeadMouse is tracking and then quits tracking because it loses sight of the target.?

A: The HeadMouse continues looking, for a brief period, in the immediate vicinity of the last known target position and if it doesn't recapture, it begins searching over it's entire FOV.

Q: What happens when two valid targets are in the FOV at the same time?

A: The HeadMouse begins searching over it's FOV and captures the target with the best return. The best return is usually from the target closest to the sensor. If the HeadMouse is tracking a target and another valid target enters the FOV the HeadMouse will ignore the second one. If the HeadMouse loses track of the first target, for any reason, it will begin searching over it's entire FOV and capture the target with the best return. If the second target is brought very close (within two to three target diameters) to the first target the tracking performance will be unpredictable. If the targets are brought very close together and then separated the HeadMouse will capture and track the one with the best return.

Q: What happens when two or more HeadMouse sensors are tracking (irradiating) the same target; is there interference?

A: No, each sensor will reject radiation from the other as if it were any other infrared clutter source. There is a discussion about using multiple sensors in Chapter 2.

Q: How long does it take the sensor to find a valid target?

A: Nominally the sensor can search it's FOV and begin tracking within a third of a second.

Q: How long will the RSI (Remote Switch Interface) Transmitter's internal batteries last?

A: The RSI transmitter battery life is almost completely dependent upon usage. If the transmitter is seldom used the batteries will last for a very long period of time. If the transmitter is used for many hours a day six or seven days a week the batteries will probably last about two months.

Q: I notice that when I hold a button on the RSI Transmitter down for a long period of time the transmitter eventually quits working, why is this?

A: On occasion, a switch may be accidentally left in the actuated state (latched) for a long period of time. To prevent this occurrence from rapidly depleting the internal batteries the RSI Transmitter will time-out and temporarily disable the infrared emitter. If a switch or switches are left actuated for longer than two minutes the transmitter assumes that the switch has been accidentally left actuated and will stop all transmissions. Once the latched switch is released the transmitter will begin operating normally.

Chapter 5, Maintenance

Cleaning the HeadMouse Optics

Warning: The optical assembly is a factory aligned and calibrated unit. Field disassembly of the optical front end is *not* possible and if attempted will void the warranty.

Caution: The HeadMouse apertures are covered with a plastic window and as such are subject to damage. Use extreme care while attempting to clean the windows.

To remove dust use a common lens brush or blower available from your local photographic supply store. Be sure to remove all grit before wiping the window with lens paper. Use clean, soft lens paper moistened with mild soap and water or alcohol and gently rub in a circular motion until the debris is removed. One should use the least amount of force required to remove the debris. Do not soak the sensor, use only enough liquid to lightly moisten the windows.

If very stubborn debris is stuck to a window, try applying more moisture, to the debris, and allow it soak into the debris. (*Do not soak or immerse the HeadMouse.*) Once the debris is loosened, remove it; several treatments may be necessary. If the debris is firmly attached or if damage to the window has occurred, return the sensor to Origin Instruments for prompt repair.

Debris removal or damage caused by debris or its removal is not covered by the warranty.

Cleaning the Smart Cable

Warning: Field disassembly or immersion of a Smart Cable is *not* recommended and if damage results it will void the warranty.

Caution: Smart Cables contain embedded electronics and can be damaged if immersed or subjected to severe mechanical abuse.

The Smart Cable does not require regular maintenance. If the Smart Cable becomes soiled it may be cleaned using standard cleaners used on common plastics. However, as part of the cleaning process the Smart Cable should *not* be immersed or soaked.

Damage caused from immersing or soaking the Smart Cable is not covered by the warranty.

Replacing the Internal Batteries to the Remote Transmitter

Warning: *The warranty does not cover damage caused by inserting the batteries improperly.*

Caution: The remote transmitter is not protected against reversing the polarity of the internal batteries. **If the batteries are inserted incorrectly it will damage the transmitter.**

To replace the remote transmitter batteries remove the four attachment screws and the top cover. Then remove the three AA-size, 1.5 volt batteries and replace all three with a fresh set of alkaline batteries. Do not use carbon zinc batteries. The batteries and the inside of the remote transmitter are shown in Figure 7. Pay close attention to the proper orientation of the replacement batteries. **The batteries must be inserted in the proper orientation or the transmitter will be damaged.** It is very important to use alkaline batteries and to replace all three batteries together for proper operation of the transmitter. Finally replace the cover and the four screws. Do not over tighten the four cover screws.

User Serviceable Parts

There are no user serviceable parts within the HeadMouse optical sensor or Smart Cables. All service is performed by Origin Instruments or an authorized agent of Origin Instruments. *Service attempted by unauthorized personnel will void the warranty.*

Appendices

Appendix A. HeadMouse Sensor Specifications

Sensor Size:	7.3 x 5.7 x 1.5 inches
Operating Range:	4 to 60 inches
Field of Regard:	55° Azimuth x 55° Elevation
Measurement Resolution:	0.004 inch Typical*
Measurement Rate:	30 Measurements per Second
Operating Wave Band:	Near Infrared
Standard Target:	0.006 inch Thick by 0.25 inch Diameter, Adhesive Backed
Computer Interfaces**:	Serial Port, RS-232C With DB-9 Connector Apple Macintosh Smart Cable IBM PS/2 Smart Cable
Wired Switch Interface:	Two 1/8 inch (3.5 mm) Microphone Jacks
HeadMouse Power:	9 watts, 14 to 16 Volts AC or 16.5 Volts DC

* Measurement parameters are RMS values and are quoted for 0.25 inch diameter target at 32 inches range under normal florescent room lights. Values will vary with operating range and target diameter, and to some extent with ambient illumination and target position in the field of regard.

** The default communication link, which is a standard RS-232 serial port, can be used by most IBM PCs and compatibles. Origin Instruments Smart Cables are available for communicating with personal computers from Apple Macintosh and with workstations from various manufacturers. These Smart Cables have microprocessors embedded in one of the connector housings that converts the HeadMouse data format to the Apple Macintosh or IBM PS/2 mouse formats.

The HeadMouse emulates the Microsoft Mouse data format as extended by Logitech Corp. for three mouse buttons. For proper HeadMouse operation the host computer must install the appropriate mouse driver software.

Appendix B. Remote Switch Interface (RSI) Specifications

RSI Transmitter Size:	2.6 x 4.25 x 1.125 inches
RSI Receiver Size:	2.6 x 4.25 x 0.875 inches
Operating Range:	Up to 10 Feet
Transmit Pattern:	40 Degree Cone
Receiver Field-of-View:	100 Degree Cone
Switch Sample Rate:	32 Measurements per Second
Operating Wave Band:	Near Infrared
Switch Interface:	Two 1/8 inch (3.5 mm) Stereo Microphone Jacks*
RSI Receiver Power:	Powered by the HeadMouse
RSI Transmitter Power:	Internal: 3 AA-Size, 1.5 Volt Alkaline Cells** External: 8 to 24 Volts DC***

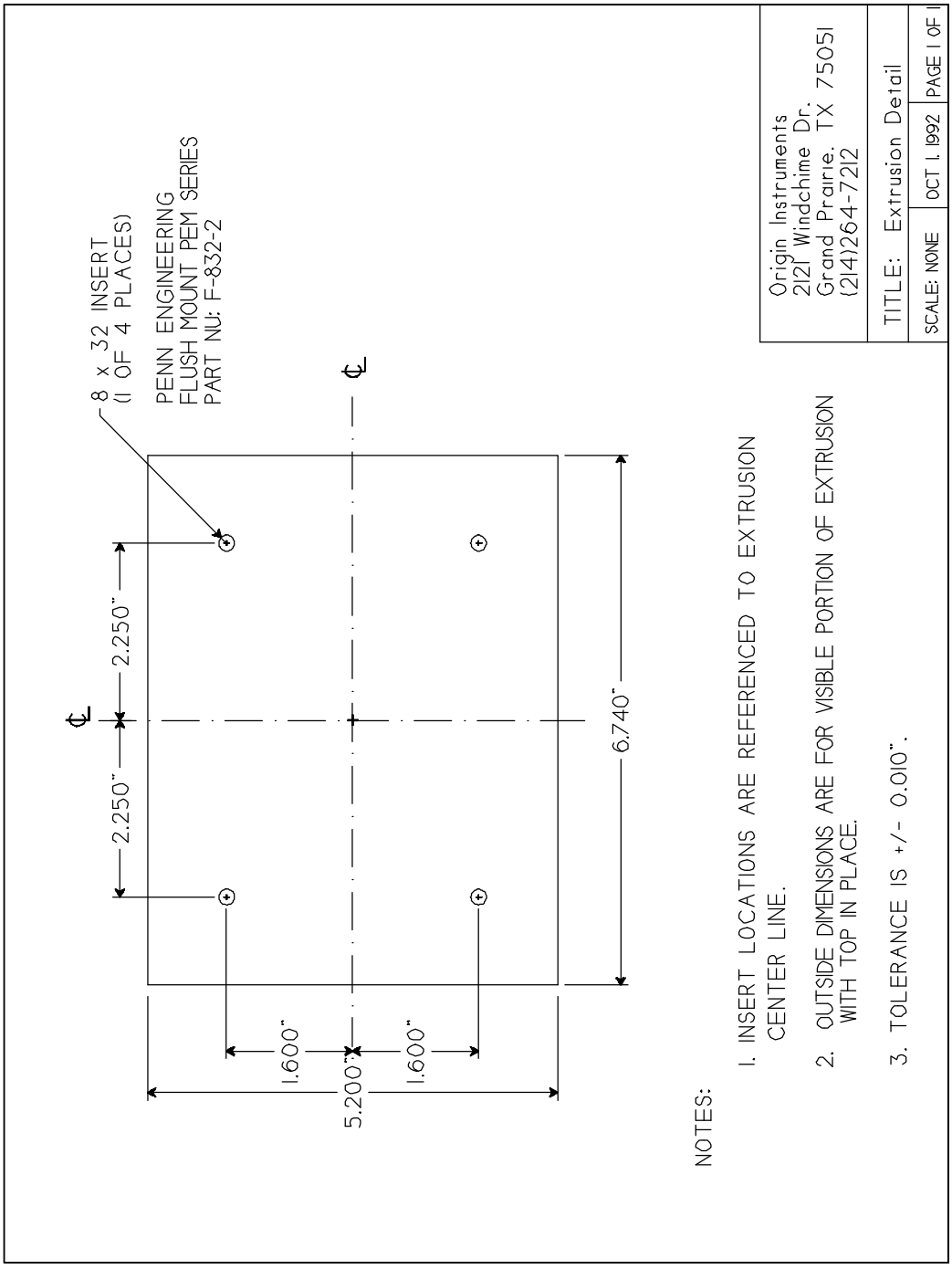
* The remote infrared transmitter uses 1/8 inch (3.5mm) stereo microphone jacks and can be jumpered to accept mono or stereo plugs (from the factory, the unit comes jumpered for mono plugs). In the “STEREO” operating mode the RSI Transmitter can transmit the state of up to three switches and emulate the “Left”, “Right”, and “Middle” mouse buttons. For Apple Macintosh computers the mouse button is input to the HeadMouse as the “Left” mouse button.

** Typical HeadMouse users will experience internal battery life of several months.

*** Designed for direct connection to a 12- or 24-volt battery.

The HeadMouse emulates the Microsoft Mouse data format as extended by Logitech Corp. for three mouse buttons. For proper HeadMouse operation the host computer must install the appropriate mouse driver software.

Appendix C. Mounting Plate Details



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