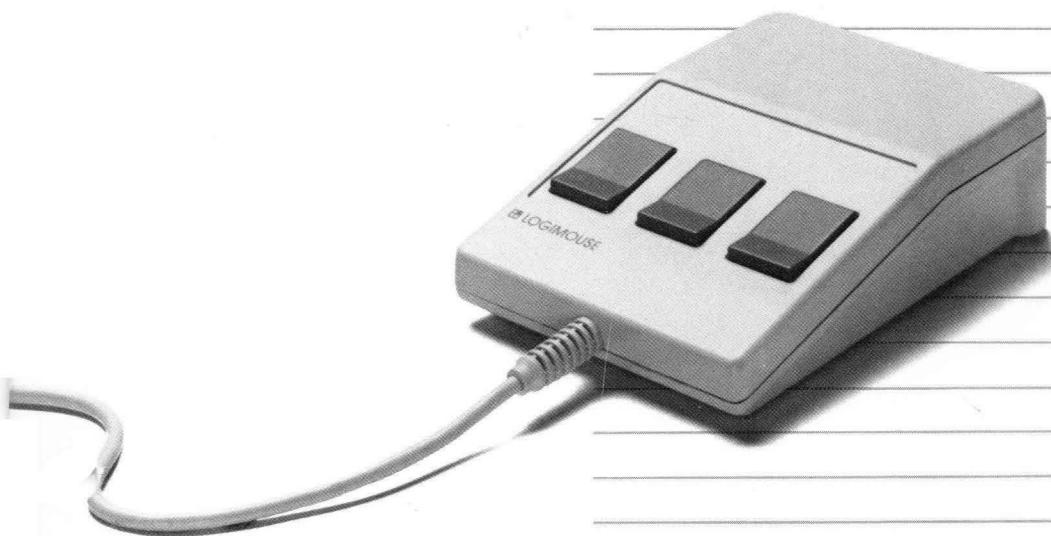


# LOGIMOUSE<sup>®</sup>C7

## Technical Reference Manual



**L O G I M O U S E C 7**

**Firmware Revision 3.0**

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## 1 INTRODUCING LOGIMOUSE

LOGIMOUSE by LOGITECH is a fifth generation product which has been improved several times since its introduction in 1976 at the Swiss Federal Institute of Technology in Lausanne, Switzerland. Its unique opto-mechanical design makes it the most reliable, highest resolution mouse available. It features excellent tracking on any surface, multiple interfaces, fully debounced buttons and an easy-to-use, ergonomic shape.

The opto-mechanical LOGIMOUSE is both highly precise and elegantly simple. The user moves the mouse over a table top, rotating the ball underneath. The ball movement is translated into X and Y movements by two perpendicular shafts activated by the ball. The motion of a shaft, sensed by optical decoders, causes the two output bits for that direction to form waves in quadrature. Frequency is determined by the speed, and phase (+/- 90 degrees) is determined by the direction of travel.

The core of the mouse is a single piece of mold-injected plastic and the remaining pieces are either injected plastic or stainless steel. The freely moving ball can be removed easily for shipping and cleaning.

LOGIMOUSE comes with either a parallel or serial interface. LOGIMOUSE C7 is a serial interface model based on low power CMOS technology.

The C7 mouse is a microprocessor controlled mouse. The firmware of the microprocessor implements all the software controlled functions of the mouse, as well as the movement and button management (except for the mechanical tracking and optical encoding). The current revision of the firmware 3.0, running on this C7 product and described in this document, is an evolution of the firmware used by previous LOGITECH serial mouse products.

## LOGIMOUSE C7

### 2 LOGIMOUSE C7

The serial LOGIMOUSE C7 offers the quickest and easiest way to position the cursor on the CRT screen. LOGIMOUSE C7 interfaces through the RS232 port of the host computer. It performs optimally on the small amount of power available on the RTS and DTR control lines of the host system's serial port and requires no external power supply.

A dedicated processor within the mouse relieves the host system of the time consuming task of counting X and Y pulses. The mouse internally processes the output of the encoders and the switches, and communicates this information to the computer using a byte oriented protocol. The underlying line characteristics are those of a serial communication channel implementing a standard RS232 specification, with one data line in and one data line out.

In addition to hardware interfacing, the serial mouse must also interface with the software of the host system. A protocol must be established to regulate the communication between the two. The protocol is a set of rules and data formats for data exchange between the mouse and the host.

LOGIMOUSE C7 implements all the major mouse protocols including Microsoft, Mouse Systems Corp., Summagraphics, and LOGITECH. Data formats are software selectable. Mouse Systems protocol is currently the default protocol, but an OEM may choose another protocol for default.

There are three available models of the LOGIMOUSE C7:

- o C7  
The C7 has a five-byte format with a 1200 baud rate.
- o C7-M  
The C7-M is Microsoft hardware compatible, Microsoft format with a 1200 baud rate.
- o C7-SG  
The C7-SG is Summagraphics hardware compatible, MM Series format with Auto Baud.

All three models respond to the full set of commands. In addition, there are two standard cable options:

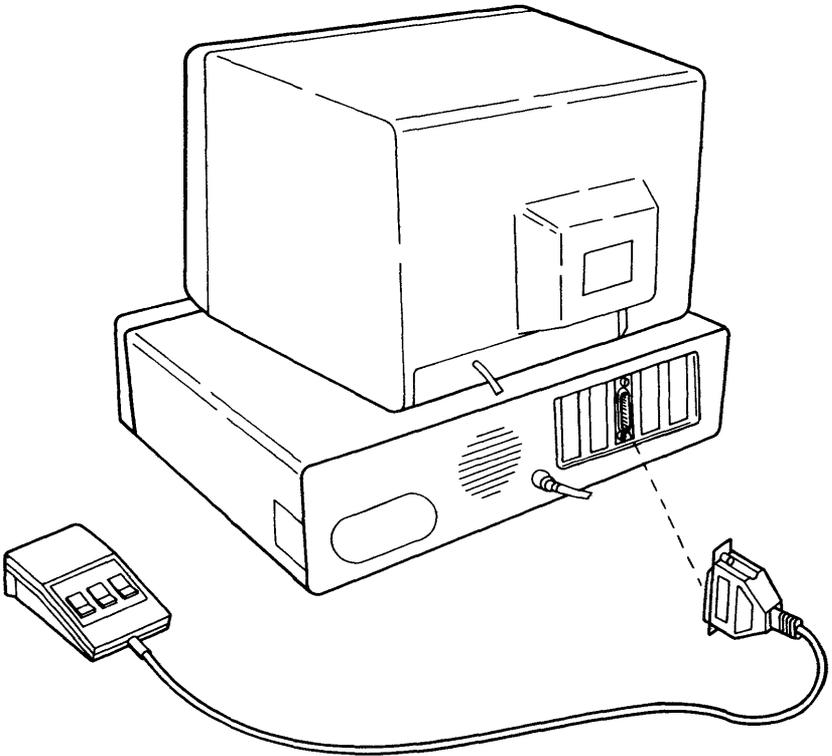
- o 25-pin D-subminiature female, DCE (compatible with the IBM PC/XT)
- o 9-pin D-subminiature female, (compatible with the IBM PC/AT 9-pin serial port)

**3 LOGIMOUSE INSTALLATION**

Begin by ensuring that the computer is turned off.

Press the RS232 plug at the end of the mouse cable into an RS232 port at the back of the computer.

NOTE: Some computers require an adaptor to make LOGIMOUSE compatible with their RS232 port. If you are using an adaptor, press the RS232 plug at the end of the mouse cable into one side of the adaptor. Then press the other side of the adaptor into the computer's RS232 port.



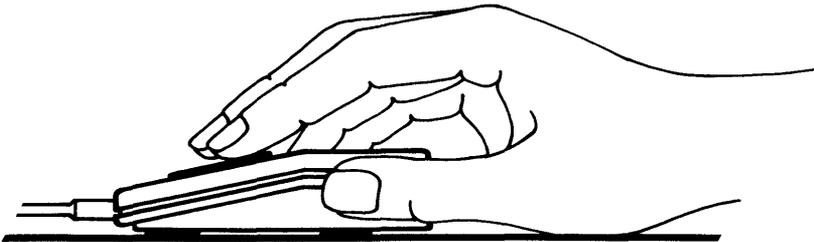
## LOGIMOUSE C7

### 4 OPERATING THE MOUSE

Depending on whether you are right or left handed, you may position the mouse on whichever side of the keyboard is most comfortable for you.

LOGIMOUSE fits your hand when your hand is in a natural, relaxed position. Very little hand movement is required to move the cursor from one side of your screen to the other.

Place the mouse on the table top with the cable pointing away from you. Place your first three fingers on the mouse buttons. Your wrist falls naturally to the table surface and your thumb and last finger hold the mouse at either side. Move the mouse by pivoting your hand at the wrist.



The functions of the buttons depend on the application software you are using. Refer to the software documentation to identify the button functions for your mouse.

**5 SPECIFICATIONS**

LOGIMOUSE uses a high precision opto-mechanical encoder. Standard resolution is 200 Dots Per Inch (DPI). Three debounced micro-switch buttons are user-assignable.

**5.1 Physical Specifications**

**Size:** Height 27 mm, length 96.5 mm,  
width 68 mm

**Weight:** 135 grams without cable

**Buttons:** Three, electronically debounced  
Two upon request

**Cable:** Six wire, 1.20 meter standard  
25 pin D-subminiature DB25S female  
connector (IBM PC/XT compatible)  
9 pin D-subminiature female connector  
(IBM AT compatible)  
Custom connector upon request

**5.2 Electrical Specifications**

**Power:** Drawn from the RS232C interface signals  
RTS (Request to Send), DTR (Data Terminal  
Ready) and RxD (Receive Data, from host  
to mouse).  
Requirements:  
RTS and DTR: +6V to +15V @ 2.5 mA or  
-8V to -15V @ 2.5 mA (per  
signal, any combination)  
RxD: -6V to -15V @ 2.5 mA  
These requirements are compatible with  
standard RS232C drivers.

**Interface:** RS232C compatible

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**5.3 Performance Specifications**

Resolution: 200 dots per inch (8 dots per millimeter)  
0.125 mm resolution  
  
Optional 320 dots per inch (12.66 dots  
per millimeter)  
0.079 mm resolution

Tracking Speed: 0.5 m/sec (20 in/sec)

Acceleration: 5 m/sec/sec (0.5 g)

**5.4 Operational Specifications**

Reporting Modes: Selected by software commands  
  
Incremental Stream  
Prompt

Data Formats: Selected by jumpers or software commands  
  
MM Series (Delta mode)  
Microsoft compatible format  
Bit Pad One (Absolute)  
Bit Pad One (Relative)  
Five Byte Packed Binary (Mouse Systems  
Corp. compatible)  
Three Byte Packed Binary  
Hexadecimal

Reporting Rates: Selected by software commands  
  
10, 20, 35, 50, 70, 100 and 150 and  
continuous reports per second (at 9600  
baud)

Baud Rates: Selected by jumpers or by software  
commands  
  
9600, 4800, 2400, and 1200 baud

Default Configuration:  
  
Five Byte Packed Binary format  
1200 baud  
Continuous reports  
Incremental Stream reporting mode

**6 CONNECTOR PIN ASSIGNMENTS**

LOGIMOUSE C7 comes with either a standard RS232C Subminiature DB25S female connector compatible with the IBM PC/XT or a DB9S Subminiature female connector compatible with the IBM AT.

Data Signals

<u>9 Pin</u>	<u>25 Pin</u>	<u>Wire Name</u>	<u>Comments</u>
shell	1	Protective Ground	
3	2	Receive Data	Serial Data from host to LOGIMOUSE
2	3	Transmit Data	Serial Data from LOGIMOUSE to host
7	4	RTS	Connected to CTS
8	5	CTS	Connected to RTS
6	6	DSR	Connected to DTR
5	7	Signal Ground	
4	20	DTR	Connected to DSR

RTS = Request to Send  
 CTS = Clear to Send  
 DSR = Data Set Ready  
 DTR = Data Terminal Ready

**7 INPUT AND OUTPUT LEVELS**

LOGIMOUSE voltage levels are as follows:

Most positive voltage = 'Space' = 'High' = 'On' = '0' = Start bit  
 Most negative voltage = 'Mark' = 'Low' = 'Off' = '1' = Stop bit

These levels are the standard RS232C levels as seen on the output of the drivers and the input of the receivers.

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### 8 SERIAL INTERFACE OPERATION

LOGIMOUSE C7 communicates with its host via an asynchronous half-duplex serial interface. Bytes are framed by one start bit and two stop bits (one or two stop bits for characters sent to the mouse). The number of bits per byte and parity are determined by the selected format.

Communication with the host is in half-duplex mode. If a byte is sent to the mouse while it is transmitting, it will generate a break on the output of at least nine space bits and will read the incoming byte. This only occurs in the Incremental Stream Mode (see below) when the host wants to change the operating mode of the mouse. Current data output from the mouse is therefore irrelevant.

### 9 BAUD RATE SELECTION

The baud rate of LOGIMOUSE C7 is set by two jumpers or by software (see section on Programmable Baud Rate Selection). The possible settings are:

- o 1200 baud
- o 2400 baud
- o 4800 baud
- o 9600 baud

#### Auto Baud Selection

A special setting configures the mouse for Auto Baud (see the section on JUMPER SETTINGS). In the Auto Baud mode LOGIMOUSE C7 determines the baud rate by timing the first character it receives from the host. To ensure correct setting of the baud rate, the host should wait at least five seconds after power-up and then send an ASCII space character (20H). The five second delay allows the mouse to execute internal initializations. When the mouse has successfully timed the received space character, it will respond with an ASCII ACK (06H) at the proper baud rate. No other character should be sent to the mouse until the ACK is received. Valid baud rates are 9600, 4800, 2400 and 1200 baud.

LOGIMOUSE C7 will respond with an ASCII ACK (06H) whenever it receives an ASCII space (20H).

## 10 COORDINATES

Coordinates are either relative or absolute. Relative coordinates measure the (signed) displacement that has occurred since the last report. Absolute coordinates presuppose an arbitrary origin, with all reports sending X and Y coordinates relative to this origin.

In all modes, position data is always latched prior to the generation of a report. The coordinates, therefore, represent the exact position of the mouse at the beginning of the report generation.

With the mouse positioned with the cable at the top, X represents horizontal movement, positive to the east, negative to the west. Y represents vertical movement, positive to the north and negative to the south (exception: see Microsoft Compatible Format).

The internal X and Y counters of LOGIMOUSE C7 are always 16 bits wide. Eight bit formats are limited to +/- 127 counts. The mouse uses 'sticky counters' so that if the X and/or Y values overflow, only maximum movement will be reported.

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### **11 BUTTONS**

The LOGIMOUSE buttons or keys are software debounced. The value sent by the mouse represents the actual state of the switches at the beginning of the report generation. Keys are not latched, making it the host's responsibility in the Prompt Mode to ask for reports often enough so as not to miss a key action. In the Incremental Stream Mode, a report is automatically generated on every key change.

### **12 DATA FORMATS**

LOGIMOUSE C7 sends position and key data in various formats, emulating most other available mice and pointing devices. The host controls the operation of the mouse and sets operating parameters by sending commands. Movement information is sent from the mouse to the host to update the screen cursor.

LOGIMOUSE C7 may be set to communicate with the host in seven different formats selected by commands or jumpers, as follows:

- MM Series (Delta Mode)
- Microsoft compatible
- Absolute Bit Pad One Packed Binary
- Relative Bit Pad One Packed Binary
- Five byte Packed Binary (Mouse Systems Corp. compatible)
- Three byte Packed Binary
- Hexadecimal

### 12.1 MM Series Data Format

In the MM Series Data Format data is transferred in the form of nine bit bytes (eight data bits and one odd parity bit). Each report contains three bytes, one for the key data and X and Y direction, followed by one byte for X distance and one for Y distance. X and Y are the distance travelled by the mouse since the last report. They represent relative movements.

The command to select the MM Series Format is 'S' (53H).

<u>P</u>	<u>7</u>	<u>6</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>Bit number</u>
PO	1	0	0	Sx	Sy	L	M	R	Byte 1
PO	0	X6	X5	X4	X3	X2	X1	X0	Byte 2
PO	0	Y6	Y5	Y4	Y3	Y2	Y1	Y0	Byte 3

PO = Odd Parity Bit

Sx,Sy = X and Y Sign bits, 1 = Positive, 0 = Negative

L,M,R = Key data (Left, Middle, Right key), 1 = key depressed

X0-X6 = X distance (unsigned binary number) value 0 to +127

Y0-Y6 = Y distance (unsigned binary number) value 0 to +127

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### 12.2 Microsoft Compatible Data Format

In the Microsoft Compatible Format, data is transferred in the form of seven bit bytes. Each report consists of three bytes. X and Y are relative movements. In the Microsoft Compatible Format, Y movement is positive to the south and negative to the north.

The command to select the Microsoft Compatible Format is 'V' (56H).

<u>6</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>Bit number</u>
1	L	R	Y7	Y6	X7	X6	Byte 1
0	X5	X4	X3	X2	X1	X0	Byte 2
0	Y5	Y4	Y3	Y2	Y1	Y0	Byte 3

L,R = Key data (Left, Right key) 1= key depressed

X0-X7 = X distance 8 bit two's complement value -128 to +127

Y0-Y7 = Y distance 8 bit two's complement value -128 to +127  
Positive = South

If LOGIMOUSE C7 is set by jumpers to the Microsoft Compatible Format, at power-up it will send one character 'M' (4DH). No character is sent if the Microsoft Compatible Format is selected with a command.

LOGIMOUSE C7-M always sends 'M' (4DH) when the host toggles the RTS signal line. In response to a Microsoft driver reset (i.e. toggling RTS), LOGIMOUSE C7-M sets up its operating parameters to Microsoft compatible format, Incremental Stream, continuous reports, 1200 baud, regardless of the current settings or the jumpers.

### 12.3 Absolute Bit Pad One Packed Binary Format

In the Absolute Bit Pad One Packed Binary Format, data is transferred in the form of eight bit bytes (seven data bits and even parity). In this format LOGIMOUSE C7 mimics the Bit Pad One digitizer. Coordinates reflect the absolute position of the mouse relative to an arbitrary origin. The first output is assumed to be the origin (0,0). The mouse never outputs a negative coordinate. Coordinates that move in a negative direction are reset to zero. The origin is also reset. A new origin may be defined at any time by sending the command 'A' (41H).

The command to select Absolute Bit Pad One Format is 'A' (41H).

P	6	5	4	3	2	1	0	Bit number
PE	1	0	L	M	R	0	0	Byte 1
PE	0	X5	X4	X3	X2	X1	X0	Byte 2
PE	0	X11	X10	X9	X8	X7	X6	Byte 3
PE	0	Y5	Y4	Y3	Y2	Y1	Y0	Byte 4
PE	0	Y11	Y10	Y9	Y8	Y7	Y6	Byte 5

PE = Even Parity bit

L,M,R = Key data (Left, Middle, Right key), 1 = key depressed

X0-X11 = X absolute position (12 bit positive number) value 0 to 4095

Y0-Y11 = Y absolute position (12 bit positive number) value 0 to 4095

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12.4 Relative Bit Pad One Packed Binary

The format of the bytes and their sequence is identical in this mode to those in Absolute Bit Pad One. However, X and Y coordinates are relative. They represent the signed distance since the last report.

The command to select Relative Bit Pad One Format is 'B' (42H).

<u>P</u>	<u>6</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>Bit number</u>
PE	1	0	L	M	R	0	0	Byte 1
PE	0	X5	X4	X3	X2	X1	X0	Byte 2
PE	0	X11	X10	X9	X8	X7	X6	Byte 3
PE	0	Y5	Y4	Y3	Y2	Y1	Y0	Byte 4
PE	0	Y11	Y10	Y9	Y8	Y7	Y6	Byte 5

PE = Even Parity

L,M,R = Key data (Left, Middle, Right key), 1 = key depressed

X0-X11 = X distance, 12 bit two's complement value -2048 to +2047

Y0-Y11 = Y distance, 12 bit two's complement value -2048 to +2047

12.5 Five Byte Packed Binary Format (Mouse Systems Corp.)

In the Five Byte Packed Binary Format data is transferred in the form of eight bit bytes (eight data bits without parity). One byte of key information and two successive data reports are sent. The second set of X,Y data (bytes 4 and 5) is not a duplicate, but the movement of the mouse during transmission of the first report. It may not be discarded.

The command to select Five Byte Packed Binary Format is 'U' (55H). Five Byte Packed Binary Format is compatible with the Mouse Systems Corporation format.

7	6	5	4	3	2	1	0	Bit number
1	0	0	0	0	L*	M*	R*	Byte 1
X7	X6	X5	X4	X3	X2	X1	X0	Byte 2
Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0	Byte 3
X7	X6	X5	X4	X3	X2	X1	X0	Byte 4
Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0	Byte 5

L\*,M\*,R\* = Key data (Left, Middle, Right key), 0 = key depressed

X0-X7 = X distance two's complement, value -128 to +127

Y0-Y7 = Y distance two's complement, value -128 to +127

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**12.6 Three Byte Packed Binary Format**

In the Three Byte Packed Binary Format, data is transferred in the form of eight bit bytes (eight data bits, no parity).

The command to select Three Byte Packed Binary Format is 'T' (54H).

<u>7</u>	<u>6</u>	<u>5</u>	<u>4</u>	<u>3</u>	<u>2</u>	<u>1</u>	<u>0</u>	<u>Bit number</u>
0	0	0	0	0	L	M	R	Byte 1
X7	X6	X5	X4	X3	X2	X1	X0	Byte 2
Y7	Y6	Y5	Y4	Y3	Y2	Y1	Y0	Byte 3

L,M,R = Key data (Left, Middle, Right key), 1 = key depressed

X0-X7 = X distance (two's complement), value -128 to +127

Y0-Y7 = Y distance (two's complement), value -128 to +127

### 12.7 Hexadecimal Format

The Hexadecimal Format encodes the key and movement data into hexadecimal digits, ASCII coded. A report is five bytes long. Data is transferred with eight bits per byte without parity. Key information is sent as one digit (ASCII '0' to ASCII '7'). Eight bit values for X and Y movements are sent as two successive hexadecimal digits (ASCII '0' to '9' and 'A' to 'F') with the least significant digits first. Interpretation of the values is identical to the Three Byte Packed Binary Format.

The command to select Hexadecimal Format is command 'W' (Hex 57).

Example: The Report 63E52 means:

```
6 = left and middle switch depressed
3E = -29 (E3, -1D hex) increments on the X axis since
    last report
52 = +37 (25 hex) increments on the Y axis since last
    report
```

## 13 REPORTING MODES

LOGIMOUSE C7 has two reporting modes. In the Incremental Stream Mode LOGIMOUSE C7 generates reports at a rate that is defined by the host. In the Prompt Mode LOGIMOUSE C7 waits for a Prompt command from the host before it generates a report.

### 13.1 Incremental Stream Mode

LOGIMOUSE C7 generates reports at rates of 10 to 150 per second at 9600 baud, or continuously with no intervals between successive reports. Data is only sent if the mouse has moved since the last report. A change in the status of the buttons, caused by depressing or releasing a button, immediately generates a report. This ensures that no switch changes are missed, even at the lowest report and baud rates. When the mouse is motionless and the status of the buttons is unchanged no reports are generated.

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### 13.2 Prompt Mode

In Prompt Mode LOGIMOUSE C7 waits for a command before it generates a report. Since the buttons are not latched, the host must be sure to poll the mouse often enough so as not to miss a button action.

## 14 LOGIMOUSE C7 COMMANDS

### 14.1 Report Rate Selection

In the Incremental Stream Mode, LOGIMOUSE C7 sends data at rates of between 10 reports per second and continuous reporting. The default value of continuous reports may be changed by sending one of the following commands to the mouse:

<u>ASCII</u>	<u>HEX</u>	<u>New rate</u>
J	4A	10 reports per second
K	4B	20 reports per second
L	4C	35 reports per second
R	52	50 reports per second
M	4D	70 reports per second
Q	51	100 reports per second
N	4E	150 reports per second
O	4F	continuous reports

If in the Prompt Mode, LOGIMOUSE C7 also reverts to the Incremental Stream Mode when one of the above commands is issued. The above report rates are valid for operation at 9600 baud and either MM Series or Three Byte Packed Binary format. At slower baud rates transmission delay is added to the delay between reports. Therefore, at slower baud rates, report rates are substantially lower. Longer data formats also reduce the report rate.

### 14.2 Prompt Mode

The Prompt Mode is entered by sending the ASCII 'D' command (44H). LOGIMOUSE C7 will not send a report until one is requested by the Prompt command, 'P' (50H). Sending the 'P' command also puts the mouse in Prompt Mode, if it is not already.

<u>ASCII</u>	<u>HEX</u>	<u>Function</u>
D	44	Select Prompt Mode
P	50	Prompt to send a report (also enters Prompt Mode)

### 14.3 Data Format Selection

LOGIMOUSE C7 has seven transmission data formats in which it communicates with the host. A new data format is selected by sending the appropriate one byte command as follows:

<u>ASCII</u>	<u>HEX</u>	<u>New Format</u>
A	41	Absolute Bit Pad One Packed Binary Format
B	42	Relative Bit Pad One Packed Binary Format
S	53	MM Series Data Format
T	54	Three Byte Packed Binary Format
U	55	Five Byte Packed Binary Format (Mouse Systems Corp. compatible format)
V	56	Microsoft Compatible Format
W	57	Hexadecimal Format

Every format command clears the mouse movement increment counters. This feature may be used to force a new origin in the Absolute Bit Pad One Mode by sending command 'A' (Hex 41), or to clear the internal 16 bit counters of the mouse.

All seven formats may be selected at power-up by setting the appropriate jumpers. See the corresponding section for complete information about jumper settings.

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The default value for the Incremental Stream Mode is continuous reports. Any format or mode may be selected at any time with a command from the host regardless of the power-up jumper settings.

### 14.4 Programmable Baud Rate Selection

The LOGIMOUSE C7 baud rate can be programmed with simple commands. Baud rate commands are two bytes long. The first byte is always '\*' (2AH) followed by a second byte which selects the baud rate.

Command:

<u>ASCII</u>	<u>HEX</u>	<u>New Baud Rate</u>
*n	2A,6E	1200 baud
*o	2A,6F	2400 baud
*p	2A,70	4800 baud
*q	2A,71	9600 baud

Both command bytes must be sent at the current baud rate. Allow at least 10 milliseconds for the mouse to switch to the new baud rate before sending a command at that rate.

### 14.5 Status and Diagnostic

For compatibility with the SummaMouse, LOGIMOUSE C7 responds to Status and Diagnostic commands.

#### 14.5.1 Status

Status is requested by sending the ASCII command 's' (73H). Status byte returned:

b7	b6	b5	b4	b3	b2	b1	b0
0	md	0	0	1	1	1	1

Only bit 6 is relevant for LOGIMOUSE C7:

md = 0	Indicates mouse is in Incremental Stream Mode
md = 1	Indicates mouse is in Prompt Mode

The remaining bits have the following values: Infrared led OK, red led OK, standard format, vertical orientation, orientation established, optics calibrated. Together they simulate a healthy SummaMouse.

14.5.2 Diagnostic

A diagnostic report is obtained by sending the command '<enq>' (05H). The mouse answers with the following three bytes: (key data, followed by two bytes with undefined data)

7	6	5	4	3	2	1	0	Bit number
u	u	u	u	u	L	M	R	Byte 1
u	u	u	u	u	u	u	u	Byte 2
u	u	u	u	u	u	u	u	Byte 3

L,M,R = Key Data (Left, Middle, Right), 1 = depressed key  
 u = Undefined data

14.6 Format and Revision Number

LOGIMOUSE C7 sends a byte with its firmware revision number and the current format in response to the command 'f' (66H). The bits have the following meaning:

7	6	5	4	3	2	1	0	Bit number	
rv3	rv2	rv1	rv0	fm2	fm1	fm0	0		
fm2	fm1	fm0	Format						
0	0	0	Five Byte Packed Binary						
0	0	1	Three Byte Packed Binary						
0	1	0	Hexadecimal						
0	1	1	Bit Pad One Relative						
1	0	0	Reserved						
1	0	1	MM Series						
1	1	0	Bit Pad One Absolute						
1	1	1	Microsoft Compatible Format						

rv3	rv2	rv1	rv0	LOGIMOUSE R7/C7 Revision Number
0	0	0	0	Revision 2.0
0	0	0	1	Revision 3.0
all other values				Reserved

The current mode of the mouse (Prompt or Incremental Stream) may be obtained with the status command 's' (73H) or command 't'.

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### 14.7 Format and Mode in ASCII

LOGIMOUSE C7 sends two ASCII characters with data format and reporting mode in response to command 't' (74H).

The first character indicates format as follows:

<u>ASCII</u>	<u>Hex</u>	<u>Format</u>
A	41	Absolute Bit Pad One
B	42	Relative Bit Pad One
S	53	MM Series
T	54	Three Byte Packed Binary
U	55	Five Byte Packed Binary
V	56	Microsoft Compatible
W	57	Hexadecimal

The second character indicates mode and report rate as follows:

<u>ASCII</u>	<u>Hex</u>	<u>Mode</u>	<u>Report Rate</u>
J	4A	Incremental Stream	10 reports/sec
K	4B	Incremental Stream	20 reports/sec
L	4C	Incremental Stream	35 reports/sec
R	52	Incremental Stream	50 reports/sec
M	40	Incremental Stream	70 reports/sec
Q	51	Incremental Stream	100 reports/sec
N	4E	Incremental Stream	150 reports/sec
O	4F	Incremental Stream	Continuous Reports
D	44	Prompt Mode	

These values are compatible with the LOGIMOUSE C7 commands. The two character string can be used directly to reprogram the mouse.

#### 14.8 Copyright and Revision in ASCII

LOGIMOUSE C7 outputs its revision number upon request. When it receives the command 'c' (63H), LOGIMOUSE C7 responds with a <cr><lf> (carriage return, line feed) and the copyright message which includes the revision number. This function is useful for testing the mouse when it is connected to a simple terminal emulator. The message is terminated with a null.

#### 14.9 Low Power Mode

When it is not being moved, LOGIMOUSE C7 enters a low power mode which reduces its current consumption by a factor of approximately four. The C7 will not enter the low power mode when set to Absolute Bit Pad One data format.

##### 14.9.1 Low Power in Prompt Mode

During serial I/O LOGIMOUSE C7 is in the normal power mode. Continuously prompting the mouse will prevent it from reducing its power consumption. If power consumption is an issue, the mouse should be prompted at a lower rate when it is not being moved.

As an alternative, LOGIMOUSE may be temporarily put into Incremental Stream Mode at 10 reports per second (command 'J'). LOGIMOUSE will then send a report only if movement or key action is detected. The host should respond within 100 milliseconds with a prompt (command 'P') to resume normal operation with LOGIMOUSE in Prompt mode.

##### 14.9.2 Dormant State

To further reduce power consumption LOGIMOUSE C7 can be put into a dormant state with command 'd' (64H). In the dormant state, LOGIMOUSE C7 does not track movement or register any key action. The dormant state is left by sending any character to the mouse. This character is not interpreted by LOGIMOUSE. The mouse will send back an ACK (06H) when it is fully activated. The dormant state is primarily for battery-powered systems, in which the power consumption of the mouse may be critical.

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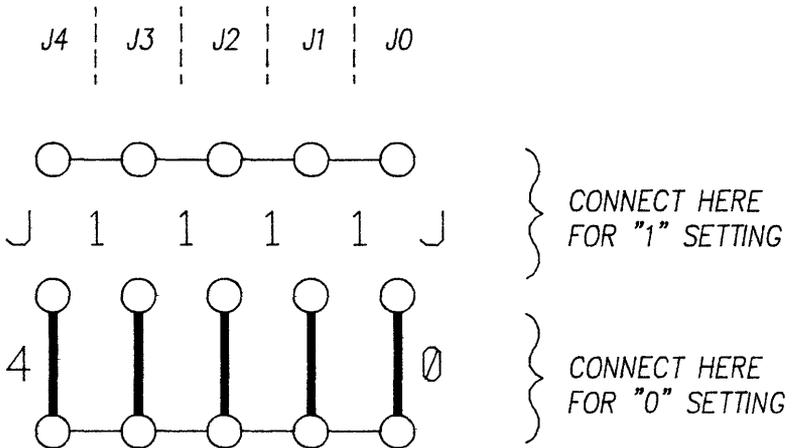
14.10 Summary of Commands

ASCII	HEX	Function
<space>	20	Timing character for Auto-Baud rate
J	4A	Incremental Stream Mode; 10 reports per second
K	4B	Incremental Stream Mode; 20 reports per second
L	4C	Incremental Stream Mode; 35 reports per second
R	52	Incremental Stream Mode; 50 reports per second
M	4D	Incremental Stream Mode; 70 reports per second
Q	51	Incremental Stream Mode; 100 reports per second
N	4E	Incremental Stream Mode; 150 reports per second
O	4F	Continuous
D	44	Select Prompt Mode
P	50	Prompt to send a report (also selects Prompt mode)
A	41	Select Absolute Bit Pad One Packed Binary Format
B	42	Select Relative Bit Pad One Packed Binary Format
S	53	Select MM Series Data Format
T	54	Select Three Byte Packed Binary Format
U	55	Select Five Byte Packed Binary Format (Mouse Systems Corp. compatible Format)
V	56	Select Microsoft compatible protocol
W	57	Select Hexadecimal Format
t	74	Send Format and mode in ASCII (two bytes)
f	66	Send format and revision number
s	73	Send one byte status
<enq>	05	Send three bytes of diagnostic
d	64	Enter Dormant State
c	63	Send copyright and revision number (in ASCII)
*	2A	Escape to special command mode
*n	2A, 6E	Set to 1200 baud
*o	2A, 6F	Set to 2400 baud
*p	2A, 70	Set to 4800 baud
*q	2A, 71	Set to 9600 baud

15 JUMPER SETTINGS

LOGIMOUSE C7 has five two-position jumpers numbered J0 to J4 which set the power-up state of the mouse. The jumpers are located on the soldered side of the PCB beneath the processor. The default configuration is all jumpers set to '0' with a small trace in the '0' position. Jumpers may be set to '1' by cutting the corresponding trace and soldering a small wire in the '1' position.

Warning: LOGIMOUSE C7 is a CMOS device. If the user opens the mouse, extra care should be taken to avoid any electrostatic discharge.



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### 15.1 Format Jumper Settings

Jumpers 0, 1 and 2 specify the format and mode at power-up as follows:

<u>J2</u>	<u>J1</u>	<u>J0</u>	<u>Format and mode</u>
0	0	0	Five Byte Packed Binary (Mouse Systems Corp compatible) Incremental Stream
1	0	0	Three byte Packed Binary, Prompt mode
0	1	0	Hexadecimal, Prompt mode *
1	1	0	Relative Bit Pad One Incremental Stream
0	0	1	Reserved
1	0	1	MM Series, Incremental Stream
0	1	1	Absolute Bit Pad, Incremental Stream
1	1	1	Microsoft compatible protocol, Incremental Stream

The default value for Incremental Stream is continuous reports.

### 15.2 Baud Rate Jumper Settings

Jumpers 3 and 4 specify the baud rate at power-up.

<u>J4</u>	<u>J3</u>	<u>Baud Rate</u>
0	0	1200 baud
0	1	2400 baud
1	0	4800 baud*
1	1	9600 baud

LOGIMOUSE C7 is set by default with all jumpers at 0. This corresponds to the Five Byte Packed Binary (Mouse Systems Corp. compatible) format at 1200 baud.

\* NOTE: The jumper setting '01010' selects MM series format, Auto Baud rate and Incremental Stream mode, not hexadecimal format, 4800 baud.

## 16 COMPATIBILITY OF LOGIMOUSE C7 WITH OTHER MICE

All the operating parameters of LOGIMOUSE C7 are under program control which makes it possible to substitute LOGIMOUSE for most other mice on the market. It is also possible, through a simple initialization sequence, for the mouse to communicate with any application program that uses a mouse. A batch command which copies the initialization text to the serial port is all that's needed to ensure application program compatibility. Some programmers may want to read the format and mode first, so that they can restore them to their original values when they exit the program.

### 16.1 Compatibility with Mouse Systems Corporation Mouse

LOGIMOUSE C7 with default jumper settings is a direct replacement of the Mouse Systems Corp. mouse, except that the resolution of LOGIMOUSE is twice that of Mouse Systems Corp. mouse. In addition, LOGIMOUSE C7 may be operated at baud rates up to 9600 baud.

### 16.2 Compatibility with SummaMouse

LOGIMOUSE C7 is fully format and mode compatible with the SummaMouse. Certain differences, which result from different operating principles, are outlined below:

To get the default setting of SummaMouse (Auto Baud rate, MM Series format) the jumpers should be set at 01010.

- o Resolution  
The resolution of LOGIMOUSE is 200 DPI, twice the resolution of the SummaMouse.
- o Calibration  
Because of its high precision mechanics, LOGIMOUSE C7 requires no calibration. After power-up the mouse is immediately in the operating mode.
- o Baud Rate  
LOGIMOUSE C7 implements only those baud rates that produce smooth tracking. 300 and 600 baud are too slow, and 19.2 kbaud offers no practical advantages over 9600 baud. LOGIMOUSE C7 implements 9600, 4800, 2400 and 1200 baud.

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### o Serial Interface

LOGIMOUSE C7 is half-duplex while SummaMouse is full-duplex. They are still compatible, however, because the Prompt mode is by definition a half-duplex mode. Sending a byte to the mouse in the Incremental Stream mode may force LOGIMOUSE to abort the byte it is currently transmitting. This is not a problem because the byte that is received forces a new mode or a new format.

### 16.3 Compatibility with the Microsoft Serial Mouse

When its jumpers are set to the Microsoft compatible format at 1200 baud, LOGIMOUSE C7 is a format compatible replacement for the Microsoft serial mouse. LOGIMOUSE C7 can be operated at any baud rate up to 9600 baud. In addition, the C7-M responds to the Microsoft reset (RTS toggle).

## 17 DIFFERENCES BETWEEN R7 1.0 and 2.0

The following are the differences between LOGIMOUSE R7 1.0 and 2.0. If you do not know which release you have, check the copyright notice on your software.

- o The baud rate of LOGIMOUSE R7 1.0 is not programmable.
- o LOGIMOUSE R7 1.0 doesn't include functions for format and revision number.
- o LOGIMOUSE R7 1.0 cannot be used at 9600 baud in Prompt mode.
- o LOGIMOUSE R7 1.0 doesn't offer Microsoft compatible format.

## 18 DIFFERENCES BETWEEN R7 2.0 AND C7 3.0

- o LOGIMOUSE C7 3.0 does not have a low resolution mode. Only 200 DPI is supported.
- o LOGIMOUSE C7 3.0 uses 'sticky counters'. Any overflow is discarded. LOGIMOUSE R7 2.0 sends overflow in following reports.
- o LOGIMOUSE R7 2.0 does not include command 't'.

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- o LOGIMOUSE C7 3.0 terminates copyright (command 'c') message with a null.
- o LOGIMOUSE C7 3.0 always sends an ACK in response to a space. LOGIMOUSE R7 2.0 sends the ACK only after successful timing in the Auto Baud mode.





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