TASMAN TURTLE MANUAL

written by

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Introduction

The Tasman Turtle is an accurate versatile robot that is easy to command from any computer language. Logo routines have been written (and are included) to help you start. With your turtle you can draw complex figures, and "feel" your way around a room.

The Turtle is interesting and educational for youngsters and researchers alike. Hook it up and try it.
Setup

Your Tasman Turtle comes with:

- Power Supply (black box)
- Interface Board and Cable
- Tasman Turtle Control Language Disk
- Warranty Card

Please send in the warranty card to get information on changes and enhancements to your turtle. This is an important step to maintain support for your turtle.

To use your turtle:

1) Turn off your Apple

2) Plug the interface card into slot 2

3) Plug in the two banana plugs into your Turtle Power Supply box. Red goes in red and black in black.

4) Turn off the power supply

5) Plug your power supply into the wall.

Now you can turn on your Apple and load in your programs. If you turn on your Turtle Power Supply before running the SETUP procedure (to put the turtle in an initial state) the turtle may have its eyes on or the horn on. This may be annoying, but not harmful.
Two small red lights should be on inside the turtle on the green boards. Further, if you push the touch ring against a sensor switch, the corresponding lamp should light in the group of four lights in the front. If none of these lights work, go back and check to see that the power supply is hooked up correctly.
**Logo Interface**

The Tasman Turtle can be commanded directly from Terrapin Logo by loading the routines on the accompanying disk in the file "TASTCL". You should feel free to modify the enclosed programs, or add new ones to extend your turtle's capability.

Here is a summary of the command you can use immediately

SETUP should be run after reading "TASTCL"

TFD :dist movement commands

TBK :dist

TRT :angle

TLT :angle

EYESON  eyes commands

EYESOFF

TPU turtle pen commands

TPD

HORNHI horn commands

HORNLO

HORNOFF

MOVEUNTIL :direction :distance :condition (see conditional motion section)

LTOUCH? outputs the state of the corresponding touch sensor- true or false. ex: IF LTOUCH? TLT 30

RTOUCH?

FTOUCH?

BTOUCH?

FTOUCHONLY?

BTOUCHONLY?

LTOUCHONLY?

RTOUCHONLY?
ANYTOUCH?
NOTOUCH?
TOUCH outputs the state of the touch sensors as a number computed as follows:
start with 0 and then
if the front is touched then add :FRONTBIT (4)
if the back is touched then add :BACKBIT (8)
if the left is touched then add :LEFTBIT (1)
if the right is touched then add :RIGHTBIT (2)

Most of these are discussed in the Terrapin Tutorial so I will only discuss the ones that are different.

Motion Commands
The motion commands (eg. TFD) are executed by a piece of assembly code for smooth motion. The source code is F.CODE and in the Logo Assembler format, allowing you to add or modify these routines. (see the Terrapin Technical Manual for Assembler information) The assembled code is in the file TASTCL.BIN and is automatically loaded by setup. IF you have some special code that you keep in the machine language space of Logo then you can use the routines in "TTCL" instead of "TASTCL"; but this will not bother most people).

Conditional Motion
The Tasman Turtle has the ability to move until it hits something. Before each turtle step, whether turning or going straight, the turtle can test its bumpers to see if it should proceed. This allows the user to control what the turtle should do if it hits something along the way.

The easiest way to use this feature is the MOVEUNTIL procedure.

MOVEUNTIL :direction :distance :condition

If you called MOVEUNTIL TFD 100 :FRONTBIT, the turtle will move 100 turtle steps,
unless it hits something in front. In that case it would stop moving and go on to the next command. The turtle can be made sensitive to more than one direction by adding the BITS before the MOVEUNTIL command.

eg. MOVEUNTIL TFD 100 :FRONTBIT + :LEFTBIT

will be sensitive to front and left touches but will ignore back and right touches.

FOR EXPERTS ONLY
Another way to use this feature is the UNTIL command.

UNTIL :condition

Takes a number or word as input and does that test before all steps in the future.

So if you said UNTIL :FRONTBIT and then TFD 100 it would do the same as MOVEUNTIL example but the condition would persist in future motion. If you call UNTIL 0 the turtle will not stop for anything, and if you call UNTIL :ANYBIT it will stop for anything.

Calling UNTIL with a number is a versatile way to control the conditions.

Combination of conditions is made by adding them as in MOVEUNTIL

The only procedures that change the UNTIL set condition, is SETUP and MOVEUNTIL.

I recommend that you play with it to see what it does. You might want to change the UNTIL procedure.
Screenturtle Option

You can have the turtle's movements reflected by the screen turtle by typing:

MAKE "SCREENTURTLE "TRUE

Many people like this option. If you want to happen all of the time you can change the SETUP routine to make "screenturtle "true rather than "false as the routine is now written.
Example

After hooking up your turtle and loading Terrapin Logo type:

READ "TASTCL"

SETUP now you are ready to go.

Maybe you want to make a square, so type

REPEAT 4 [TFD 20 TRT 90] and away it should go.
Fine Adjustments

Certain parameters can be changed to suit your preference.

:CALIBR and :CALIBL are calibration variables to make your turtle work exactly in degrees. This may range from 1.0 to 1.1 (default is 1.05). You may want to change this if your turtle does not turn exactly 180 degrees. :CALIBR is for right adjustments and :CALIBL is for left adjustments.

TSTEP is the size of each turtle step in the Forward and Backward routines. This can be changed by

.DEPOSIT :TSTEP <number> (default it 10).

TSTALL controls the speed of the turtle. This can be changed a bit but not much.

Change by

.DEPOSIT :STALL <number> (default 12).
RUNNING YOUR TASMAN TURTLE IN BASIC

The Tasman Turtle is a general purpose personal robot designed to have all the flexibility needed to encourage hobby, educational or professional use. The Turtle is easiest to use when used in conjunction with the higher level language LOGO, however, any other language including machine code can be used to run the Turtle.

The following is a brief guide to allow the Tasman Turtle to be used with Basic. You will discover new possibilities and greater versatility using the turtle robot this way.

Housed inside the Tasman Turtle™ is a General Purpose Interface board which allows up to 64 bits of input/output data to be utilised.

This is arranged as four 8 bit input ports and four 8 bit output ports:

<table>
<thead>
<tr>
<th>IN</th>
<th>OUT</th>
</tr>
</thead>
<tbody>
<tr>
<td>PORT 1</td>
<td>(W)</td>
</tr>
<tr>
<td>PORT 2</td>
<td>(W + 1)</td>
</tr>
<tr>
<td>PORT 3</td>
<td>(W + 2)</td>
</tr>
<tr>
<td>PORT 4</td>
<td>(W + 3)</td>
</tr>
</tbody>
</table>

The 8 bits of Port 1 input are dedicated to the 8 Turtle functions described below.

The first four bits of Port 3 output are dedicated to the four Turtle sense switches. All other bits are free for custom use, or for use by Turtle options such as the Turtle Talk™.

If port 2 of the Apple II is used then \( W = -16224 \) and \( R = -16222 \) where
\( W \) stands for Write (for the Turtle) and \( R \) stands for Read (from the Turtle)
To operate the turtle functions

POKE W, X

where X = 16  - lamps on
      32  - pen down
      64  - toot low
     192  - toot high

More than one function can operate simultaneously, e.g., to put the pen down and the lamps on

POKE W, 48  (48 = 16 + 32)

To turn everyone

POKE W, 0

To move the Turtle

120 POKE W, A  
110 GOSUB 10000
120 POKE W, B
130 GOSUB 10000
140 GOTO 100

10000 FOR T = 1 TO TT
10100 NEXT T
10200 RETURN

<table>
<thead>
<tr>
<th>MOTION</th>
<th>A</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forward</td>
<td>8</td>
<td>13</td>
</tr>
<tr>
<td>Back</td>
<td>2</td>
<td>7</td>
</tr>
<tr>
<td>Left</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>Right</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Right wheel</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>or</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Left wheel</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>or</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>
The value of \( \varphi \) is best between \( \varphi = 5 \); the larger the value the slower the turtle will move.

To sense the touch switches

\[
\begin{align*}
1\varphi & \ A = \text{PEEK (R)} \\
11\varphi & \ \text{IF } A = X \ \text{THEN GOSUB} \\
12\varphi & \ \text{GOTO } 10\varphi
\end{align*}
\]

or

\[
\begin{align*}
10\varphi & \ A = \text{PEEK (R)} \\
11\varphi & \ \text{IF } A = 255 \ \text{THEN } 10\varphi \\
12\varphi & \ \text{IF } X = 254 \ \text{THEN} \\
13\varphi & \ \text{IF } X = 253 \ \text{THEN}
\end{align*}
\]

\[\text{etc.}\]

Where \( X = \)

<table>
<thead>
<tr>
<th></th>
<th>L</th>
<th>R</th>
<th>F</th>
<th>B</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>254</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>R</td>
<td>252</td>
<td>253</td>
<td></td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>250</td>
<td>249</td>
<td>251</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>246</td>
<td>245</td>
<td>243</td>
<td>247</td>
</tr>
</tbody>
</table>

LFB - 242
RFB - 241
LFR - 248
LBR - 244
LDFR - 246

If no switch is operated then \( X = 255 \)
To operate the turtle functions

POKE W, X

where X = 16 - lamps on
      32 - pen down
      64 - toot low
     192 - toot high

More than one function can operate simultaneously, e.g., to put the pen down and the lamps on

POKE W, 48    (48 = 16 + 32)

To turn everything off

POKE W, 0

To move the Turtle

10 POKE W, A
110 C0SUB 1000
120 POKE W, B
130 C0SUB 1000
140 G0TO 100

1000 FOR T = 1 TO TT
1010 NEXT T
1020 RETURN

Where

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<thead>
<tr>
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<td>2</td>
<td>7</td>
</tr>
<tr>
<td>LEFT</td>
<td>10</td>
<td>15</td>
</tr>
<tr>
<td>RIGHT</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>RIGHT WHEEL</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>LEFT WHEEL</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>or</td>
<td>8</td>
<td>12</td>
</tr>
</tbody>
</table>
TASMAN TURTLE

MINIMUM CONFIGURATION (Minimum Turtle)

Functions:

- Left Motor Set Direction
- Left Motor Toggle
- Right Motor Set Direction
- Right Motor Toggle
- Horn
- Horn Tone
- Lights
- Pen Solenoid
- Auxiliary Input
- Left Sense Switch
- Right Sense Switch
- Front Sense Switch
- Back Sense Switch
Specifications:

Power Requirements
12VDC (Nominal)
1.5 Amp (Max.)

Stepping Motors
Step Angle - 7.5°
Voltage - 12VDC
Max. Frequency - 100Hz

Control Inputs
High - On
Low - Off

Sense Switches
Normally - High
Active - Low

Auxiliary Input
12VDC, 1 Amp Drive Current (Max)
High - On
Low - Off

Dimensions
Diameter - 385mm
Height - 190mm
Ground Clearance - 20mm
Drive Mechanism

Direct Drive

Wheel diameter - 60mm
Pulses per revolution - 166
Gear ratio - 3.5 : 1

Drive Logic

LMS  Left Motor Set direction
LMT  Left Motor Toggle
RMS  Right Motor Set direction
RMT  Right Motor Toggle

Set Direction High - clockwise
Low - anticlockwise

<table>
<thead>
<tr>
<th>MOTION</th>
<th>LEFT MOTOR</th>
<th>RIGHT MOTOR</th>
</tr>
</thead>
<tbody>
<tr>
<td>FORWARD</td>
<td>LOW</td>
<td>HIGH</td>
</tr>
<tr>
<td>REVERSE</td>
<td>HIGH</td>
<td>LOW</td>
</tr>
<tr>
<td>RIGHT TURN</td>
<td>LOW</td>
<td>LOW</td>
</tr>
<tr>
<td>LEFT TURN</td>
<td>HIGH</td>
<td>HIGH</td>
</tr>
</tbody>
</table>

RIGHT WHEEL (F)  LOW OFF
LEFT WHEEL (F)   OFF HIGH
RIGHT WHEEL (B)  HIGH OFF
LEFT WHEEL (B)   OFF LOW
### 25 Pin RS 232 Plug

<table>
<thead>
<tr>
<th>Pin</th>
<th>Description</th>
<th>Color</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0</td>
<td>LMT</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>LMS</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>RMT</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>RMS</td>
</tr>
<tr>
<td>5</td>
<td>0</td>
<td>Lamp</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>Pen Sol.</td>
</tr>
<tr>
<td>7</td>
<td>0</td>
<td>Horn</td>
</tr>
<tr>
<td>8</td>
<td>0</td>
<td>Tone (aux)</td>
</tr>
<tr>
<td>9</td>
<td>0</td>
<td>B SW</td>
</tr>
<tr>
<td>10</td>
<td>0</td>
<td>F SW</td>
</tr>
<tr>
<td>11</td>
<td>0</td>
<td>R SW</td>
</tr>
<tr>
<td>12</td>
<td>0</td>
<td>L SW</td>
</tr>
</tbody>
</table>

**Notes:**
- Grey/Black GND pins are used for ground connections.
- Pin numbers are counted from 1 to 25, starting from the left side of the plug.
- Colors in parentheses indicate the typical color assigned to the corresponding pin.
Maintenance

It is anticipated that the Tasman Turtle will be relatively free of maintenance, however, as with all mechanical devices, certain adjustments may have to be made from time to time and dependent on the frequency and nature of use.

Adjustments are simple to make.
Sensor Switches

See Fig. 1

1. The Peripheral Sensor Band is held in a central position by the micro switch actuators.

2. To adjust the band loosen each of the four micro switch setting screws (a1, a2, a3, a4) and the four micro switch holding screws (b1, b2, b3, b4).

3. Adjust the band until the gap A1 = A2 = B1 = B2 = approx. 3mm.

4. Tighten the screws.

5. Check that each switch is actuated by the Peripheral Sensor Band.

6. Check that the band returns to its central position after each switch is actuated.

Note: The micro switch should not be adjusted out so far that it is always actuated, nor in so far that the Peripheral Sensor Band cannot actuate it.
Motor Drive
See Fig. 2

1. Adjust for good mesh (a) between G1 and G2 by loosening the angle bracket screw (b) and adjusting wheel (c) sideways.

2. Further adjustment is possible by loosening the motor front mounting screws and pushing G1 down on G2 gently.

3. Good mesh is obtained when any visible gap between G1 and G2 just disappears.

Note: Do not adjust the angle bracket so far that the wheel rubs on the case plate.

The motor drive mechanism will vibrate if held in the air while adjusting. Test all adjustments by running on a flat surface.

Too much pressure between G1 and G2 will cause the motor to miss steps.
Pen Adjustment
See Fig. 3

1. Centering of the pen is done by adjusting the pen solenoid mounting screws.

2. Remove dome by removing the four flange nuts on the long micro switch screws.

3. The dome will move off to the side, do not pull on the cable or plugs.

4. Adjust pen solenoid by trial and error till the best centering is obtained.

5. The best centering is obtained when the pen leaves a small dot or the smallest circle when the Turtle rotates 360°.

6. The turtle can be operated with the dome disconnected by simply placing the dome over the base, but not putting the four flange screws on.

7. If centering cannot be obtained satisfactorily then the Pen bracket Screw may need to be adjusted. This should be done rarely.

8. Replace dome and flange nuts ensuring that the cable and plugs inside the turtle are satisfactory.

9. The pen must not rub against the top hole in the perspex disc.
Auxiliary Input

If a specific function is required but not provided, provision has been made for owner modifications.

1. Connect the horn-pitch input to the auxiliary input.

2. Connect the function device (solenoid, oscillator, light, DC motor, etc.,) to the auxiliary output.

3. Test by applying 12VDC to the Horn/Auxiliary input.

Note: That the two tone horn function is sacrificed to allow this modification, but the single pitch function (low pitch) is retained.