ART
Advanced Realtime Tracking

User's Guide

artdtrack *module for* ***trackd***™

version 5.8.3
January 2016

Contents

1 General

This manual describes, how to use ***DTrack***® (written as **DTrack** in this manual) data via the ***trackd***™ (written as **trackd** in this manual) interface provided by Mechdyne Corporation.
trackd is a small "daemon" application, that acts like a standard interface for tracking and input devices. A variety of VR and motion tracking software applications support **trackd**. It's available for several operating systems. To get more information about **trackd** see the "Trackd User's Guide" and "Trackd Reference Manual" by Mechdyne Corporation (http://www.mechdyne.com).

1.1 Module `artdtrack`

To run **trackd** with **DTrack1** or **DTrack2** a module called `artdtrack` must be present in the **trackd** installation. Since version 5.5 it is part of the **trackd** standard distribution. The most recent version is also available at ART's web site (http://www.ar-tracking.com) for free.
The following survey shows, which `artdtrack` module and which **DTrack** software has to be used for single **trackd** versions:

trackd	**interface**	**v5.0b – v5.7**	**v5.8**
`artdtrack`	module for **trackd** (by ART)	v0.3 – v5.7.2	v5.8.3
DTrack1	tracking software (by ART)	all versions	all versions
DTrack2	tracking software (by ART)	—	all versions

1.2 Features

- The **trackd** interface currently supports **DTrack** 6DOF objects of three kinds: "standard bodies", "Flysticks" (including up to eight buttons and the joystick) and "Measurement Tools"[1]. Other objects handled by **DTrack**, like "additional 3DOF markers", are ignored.
- **trackd** receives data from the **ART Controller**[2] via Ethernet (UDP/IP). There must be a network connection between the **ART Controller** and the machine running **trackd**.

[1] since version v5.5.1 of module `artdtrack`
[2] computer running the **DTrack2** tracking software

1.3 Data Flow

Usually the module `artdtrack` is running on the same machine like the software application that takes the tracking data (see figure 1). The **ART Controller** is sending data to a host machine via ethernet (UDP/IP), where `artdtrack` is receiving these data and handing them over to **trackd**.

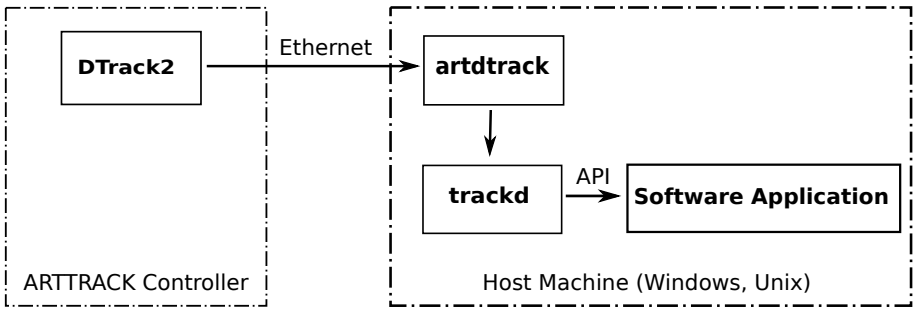

Figure 1: Data flow in a "normal" **DTrack** – **trackd** installation

1.4 Coordinate Systems

By default **trackd** uses coordinate systems of **DTrack** (for "room" and "bodies") without changes. Take a look at the "***ARTTRACK®, TRACKPACK & DTrack® System user manual***" on how to define them during the setup of the tracking system.
A "CAVELib" coordinate system (with Y axis up) can easily be set up with **DTrack**: Just use "Power wall" coordinate system when performing a "room calibration".
Beside that **trackd** provides several options to modify the coordinate systems by defining additional offsets and/or rotations (like `SensorOffset`, `TransmitterRotation`, ...; refer to **trackd**'s manuals).

1.5 Names and Numbering

DTrack and **trackd** are using differing names for tracked objects; also the numbering is different:

- Each **DTrack** "standard body" corresponds to one **trackd** "tracker" unit.
- Each **DTrack** "Flystick" corresponds to one **trackd** "tracker" unit for position and orientation and one **trackd** "controller" unit for buttons and joystick.
- Each **DTrack** "Measurement Tool" corresponds to one **trackd** "tracker" unit for position and orientation and one **trackd** "controller" unit for buttons.
- **DTrack** 6DOF objects show up as **trackd** "tracker" units in this order: First all "Flysticks", then all "Measurement Tools", finally all "standard bodies".

Example for the different ID numbering with 2 standard bodies, 2 Flysticks and 1 Measurement Tool:

DTrack		**trackd tracker**	**trackd controller**
Flystick	ID 'F1'	ID 1	ID 1
Flystick	ID 'F2'	ID 2	ID 2
Measurement Tool	ID 'M1'	ID 3	ID 3
standard body	ID '1'	ID 4	—
standard body	ID '2'	ID 5	—

A convenient way to change the order of targets is to use **trackd**'s `ConnectorOption <device name> UnitOrder`.

1.6 Flystick Input Device

Currently **DTrack2** is supporting three kinds of input devices: The ART Flystick, the ART Flystick2 and the ART Flystick3. All are equipped with some buttons, as well as a small joystick. Note that only the Flystick2 and Flystick3's joystick can provide analog values.
trackd is supporting both kind of input devices. As they carry variable number of controls, buttons and joystick of each Flystick are mapped to 8 **trackd** buttons and 2 **trackd** "controller valuators". The valuators can get values between -1.0 and 1.0.

trackd controller	**ART Flystick**	**ART Flystick2**	**ART Flystick3**
buttons 1 – 8	buttons 1 – 4	buttons 1 – 6	buttons 1 – 4
valuator 1 ("horizontal")	buttons 6, 8 ("hat switch")	joystick ("horizontal")	joystick ("horizontal")
valuator 2 ("vertical")	buttons 5, 7 ("hat switch")	joystick ("vertical")	joystick ("vertical")

1.7 Measurement Tool

The ART "Measurement Tool" so far isn't equipped with buttons. But during a "single measurement", pressing of button 1 is simulated by **DTrack2** (refer to the corresponding "***ARTTRACK®, TRACKPACK & DTrack® System user manual***").

2 Setting up DTrack2

Please refer to the "***ARTTRACK®, TRACKPACK & DTrack® System user manual***", how to set up the tracking system including all necessary calibrations.

2.1 Room Calibration

If you want to set up a CAVELib coordinate system (with Y axis up), be sure to choose "Power wall" coordinate system setting when performing a room calibration. The settings can be done in **DTrack2** menu *Calibration / Room* before starting the calibration. One can also use "normal" coordinate system and adjust trackd settings such that trackd daemon corrects coordinates itself (see Section 3.2 for details).

2.2 Output Settings

Note that two kinds of output data formats exist for Flystick data: *6df* and *6df2*. **trackd** supports both formats; but only the newer *6df2* can transport all features of the ART Flystick2 or ART Flystick3.
If the system is working, choose the following settings in **DTrack2** menu *Settings / Output*:

- Select one *Channel* for the output settings e.g. "Channel 1"
- Check *active*
- Adjust the IP address (*send to*) of the computer that **trackd** runs on
- Adjust the UDP port (*UDP port*) to correspond with the **trackd** option `port` (see section 3.2)
- *Output*: Check (activate) the output data *6d*, *6df2* (*6df*) and *6dmt2* (*6dmt*) if available

3 Setting up trackd

3.1 Installation

To make **trackd** work with **DTrack** data, a module called `artdtrack` must be present in the **trackd** installation.
If it is not part of the **trackd** distribution, you can get the latest version at ART's web site (http://www.ar-tracking.com). Download the file[1]:

```
artdtrack_<version>_<os>.<tgz|zip>
```

To install the module, just copy the module file `bin/artdtrack.so` (for UNIX) or `bin/artdtrack.dll` (for Win32) into the directory `${TRACKD_HOME}/bin/` (where also the **trackd** executable resides).

3.2 Device-Specific Options

Refer to "Trackd User's Guide" and "Trackd Reference Manual" on how to configure a **trackd** installation. Module `artdtrack` provides some additional device-specific options.
The general configuration format for defining an ART device is as follows:

```
DefineDevice <device name> artdtrack
```

trackd has to know, where to get data from **DTrack** via Ethernet; the UDP port number has to correspond with the setup of **DTrack** (see section 2.2):

```
DeviceOption <device name> port <port number>
```

Then one has to choose the numbers of **DTrack** "standard bodies", "Measurement Tools" and "Flysticks" to use:

```
DeviceOption <device name> standardbodies <number>
DeviceOption <device name> flysticks <number>
DeviceOption <device name> measurementtools <number>
```

Please note: The ART device only supports "CAVECoordinates" (which is default for **trackd**). Never try to define something like:

```
DeviceOption <device name> CAVECoordinates no
```

[1] for **trackd** 5.0b there is no HP-UX module available

If you are using normal room calibration instead of “powerwall” setup, then you have to rotate the coordinate system of transmitter to coincide with trackd coordinate system (+x right, +y up) using the following option:

```
DeviceOption <device name> TransmitterRotationMatrix 1 0 0 0 0 -1 0 1 0
```

This is nothing else but rotation matrix of normal coordinate system by 90 degrees counter-clockwise around x-axis which points toward the observer:

$$R_x(\pi/2) = \begin{pmatrix} 1 & 0 & 0 \\ 0 & cos(\pi/2) & -sin(\pi/2) \\ 0 & sin(\pi/2) & cos(\pi/2) \end{pmatrix} = \begin{pmatrix} 1 & 0 & 0 \\ 0 & 0 & -1 \\ 0 & 1 & 0 \end{pmatrix}$$

For different rotation options refer to “Trackd Reference Manual”.

3.3 Optional Device-Specific Options

trackd can use **DTrack1** or **DTrack2** remote commands (sent via Ethernet) to start and stop the tracking system. In that case the tracking system is just measuring, as long as **trackd** is running.

To control **DTrack2**, one has to add the following option containing hostname or ip address of the **ART Controller**:

```
DeviceOption <device name> remote <hostname or ip address of ART controller>
```

To control **DTrack1** remotely, one has to add the following option containing hostname or ip address of the computer running **DTrack1** (the port number has to correspond with **DTrack1**’s setting of “receive port”):

```
DeviceOption <device name> remote <hostname or ip of DTrack1 PC> <receive port>
```

3.4 Options for Shared Memory Connectors

By default, **trackd** handles just three buttons for each “controller” unit. To make all eight buttons of an ART Flystick available (as “controller” buttons and/or valuators), one has to define these options for the “controller’s” “shared memory connector”.

```
ConnectorOption <device name> NumButtons <controller id> 8
ConnectorOption <device name> NumValuators <controller id> 2
```

The options have to be repeated for each Flystick.

Measurement Tools provide just four buttons per device:

```
ConnectorOption <device name> NumButtons <controller id> 4
```

The option has to be repeated for each Measurement Tool.

3.5 Example Configurations

The following **trackd** configuration files are part of the `artdtrack` distribution.

3.5.0.1 Using one “standard body” and one “Flystick”

This configuration file establishes a connection working with one “standard body” and one “Flystick” (available as `example_one_one.conf`). It includes “shared memory connectors” for **trackd** “tracker” and “controller” devices.

```
# Sample configuration for ART device 'DTrack'

# This is an example configuration file, that connects an ART device
# with one 'standard body' and one 'Flystick' directly to a trackd daemon.

# Define the ART device:
DefineDevice ART artdtrack

# Number of 'standard bodies' and 'Flysticks':
DeviceOption ART standardbodies 1
DeviceOption ART flysticks 1

# Ethernet port (udp) to receive data from DTrack:
DeviceOption ART port 5000

# Uncomment this field if standard room calibration is used instead of "powerwall"
#DeviceOption ART TransmitterRotationMatrix 1 0 0 0 0 -1 0 1 0

# Define an output connector for 2 tracker units:
DefineConnector SHM1 shm out 2
ConnectorOption SHM1 data tracker
#ConnectorOption SHM1 UnitOrder 2 1
ConnectorOption SHM1 key 4126

# Define an output connector for 1 controller unit:
DefineConnector SHM2 shm out 1
ConnectorOption SHM2 data controller
ConnectorOption SHM2 key 4127

ConnectorOption SHM2 NumButtons 1 8
ConnectorOption SHM2 NumValuators 1 2
```

3.5.0.2 Using two “standard bodies” and two “Flysticks”

The same configuration for two “standard bodies” and two “Flysticks” could look like (see `example_two_two.conf`):

```
# Sample configuration for ART device 'DTrack'

# This is an example configuration file, that connects an ART device
# with two 'standard bodies' and two 'Flysticks' directly to a trackd daemon.

# Define the ART device:
DefineDevice ART artdtrack

# Number of 'standard bodies' and 'Flysticks':
DeviceOption ART standardbodies 2
DeviceOption ART flysticks 2

# Ethernet port (udp) to receive data from DTrack:
DeviceOption ART port 5000

# Uncomment this field if standard room calibration is used instead of "powerwall"
#DeviceOption ART TransmitterRotationMatrix 1 0 0 0 0 -1 0 1 0

# Define an output connector for 4 tracker units:
DefineConnector SHM1 shm out 4
ConnectorOption SHM1 data tracker
#ConnectorOption SHM1 UnitOrder 3 4 1 2
ConnectorOption SHM1 key 4126

# Define an output connector for 2 controller units:
DefineConnector SHM2 shm out 2
ConnectorOption SHM2 data controller
ConnectorOption SHM2 key 4127

ConnectorOption SHM2 NumButtons 1 8
ConnectorOption SHM2 NumValuators 1 2
ConnectorOption SHM2 NumButtons 2 8
ConnectorOption SHM2 NumValuators 2 2
```

3.5.0.3 Using one "standard body" and one "Measurement Tool"

This configuration file establishes a connection working with one "standard body" and one "Measurement Tool" (available as `example_measurement_tool.conf`). It includes "shared memory connectors" for **trackd** "tracker" and "controller" devices.

```
# Sample configuration for ART device 'DTrack'

# This is an example configuration file, that connects an ART device
# with one 'standard body' and one 'Measurement Tool' directly to a trackd daemon.

# Define the ART device:
```

```
DefineDevice ART artdtrack

# Number of 'standard bodies' and 'Measurement Tools':
DeviceOption ART standardbodies 1
DeviceOption ART measurementtools 1

# Ethernet port (udp) to receive data from DTrack:
DeviceOption ART port 5000

# Uncomment this field if standard room calibration is used instead of "powerwall"
#DeviceOption ART TransmitterRotationMatrix 1 0 0 0 0 -1 0 1 0

# Define an output connector for 2 tracker units:
DefineConnector SHM1 shm out 2
ConnectorOption SHM1 data tracker
#ConnectorOption SHM1 UnitOrder 2 1
ConnectorOption SHM1 key 4126

# Define an output connector for 1 controller unit:
DefineConnector SHM2 shm out 1
ConnectorOption SHM2 data controller
ConnectorOption SHM2 key 4127

ConnectorOption SHM2 NumButtons 1 4
```

4 History

artdtrack v5.8.3:

- Update for **trackd** version 5.8.
- Support of **DTrack2** remote control (to start and stop the tracking system).
- Support of **DTrack2** output formats “6di” and “6dmt2”.

artdtrack v5.5.2:

Support of “ART Flystick2”.

artdtrack v5.5.1:

Support of “Coordinate Measurement Tool”.

artdtrack v5.5.0:

Update for **trackd** version 5.5. Version renumbering to fit with **trackd**.

artdtrack v0.3.0:

Additional mapping of Flystick HAT switch to “controller” valuators.

artdtrack v0.2.1:

First distributed version.