The Open Traceable Time Platform

User Manual

Version 2.1.0

Generated October 14, 2023

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1. Introduction

This chapter gives a short introduction to the Open Traceable Time Platform (OpenTTP), describing the Reference Platform and other supported hardware.

1.1 What is OpenTTP?

The Open Traceable Time Platform is an open-source solution for a timing system that can be made fully traceable to national standards. It achieves traceability using the GPS common-view technique, which allows distant clocks to be compared with an accuracy of a few ns. The reference platform is based on readily available, low-cost OEM modules and provides a full software and hardware solution.

The goals of the OpenTTP project are:

1. Fully open source hardware and software [1]
2. Easy customisation for specialised applications
3. Production of time-transfer files in the standard CGGTTS data format (currently for GPS only)
4. Easy extension to new receivers
5. Low cost
6. Provision of a convenient framework for research and development.

Applications currently include provision of traceable time of day and auditing of NTP-synchronized systems.

[1] The Reference Platform uses some black-box software modules supplied by the FPGA vendor which cannot be freely distributed.

1.2 The OpenTTP software suite

The OpenTTP software suite provides a full solution for automated logging and processing of time-transfer data. It is available via GitHub:

`https://github.com/openttp`

Users are invited to contribute to its development.

The software supports a number of GNSS receivers and counters. The supported GNSS receivers are mostly low-cost, single-frequency receivers since low cost is a key objective of the OpenTTP project. Low-cost dual frequency receivers have recently become available and one of these, the ublox ZED-F9, is now supported by OpenTTP.

1.2.1 Supported GNSS receivers

OpenTTP currently supports the receivers listed in table 1.1.

Manufacturer	models	notes
Javad	GRIL receivers	obsolete
NVS	NV08	
Septentrio	PolaRx family	
Trimble	Resolution T	obsolete
ublox	NEO-M8T,ZED-F9P,ZED-F9T	may work with earlier receivers

Table 1.1: Supported GPS/GNSS receivers.

OpenTTP uses a custom file format for logging GPS receiver data. It does not read native receiver binary-format files.

Guidance on testing a receiver for suitability for time-transfer, and writing software to process the receiver's data, is given in the OpenTTP Developer's Guide.

1.2.2 Supported counters

Counters supported by OpenTTP are listed in 1.2.

The file format used 5.4.2 is very simple and it should be easy to convert from another format, if needed.

1.3 The OpenTTP reference platform

The OpenTTP reference platform currently consists of:

- Raspberry Pi4, an ARM-based single board computer

Manufacturer	models	notes
Agilent	5313x	needs IOTech GPIB to RS232 converter
Keysight	53230A	uses USB TMC
OpenTTP	XEM6001	simple FPGA-based counter/timer
Pendulum	CNT-9x	
SRS	PRS10	uses the input 1 pps time-tagging function
TAPR	TICC	

Table 1.2: Supported counters.

- ☐ ublox ZED-F9T GNSS receiver
- ☐ Opal Kelly XEM6001 FPGA development board
- ☐ Jackson Labs LTE Lite GPS-disciplined oscillator
- ☐ Solid-state disk for mass storage
- ☐ CrystalFontz LCD module

The prototype version used the BeagleBone Black single board computer and NVS NV08 receiver. Custom circuits, printed circuit board designs and other hardware resources are all available via the GitHub repository.

1.3.1 Licenses

The software is available under the MIT license.

2. Getting started with the Reference Platform

This chapter describes basic setup of the OpenTTP reference platform, verification of its operation and logging in to the unit.

Warning ! The unit contains a computer. This must be shut down properly before power is removed from the unit. Failure to do this can result in inoperability of the system. The system can be shut down from the front panel (2.1.1) or by logging in (2.4).

2.1 The front panel

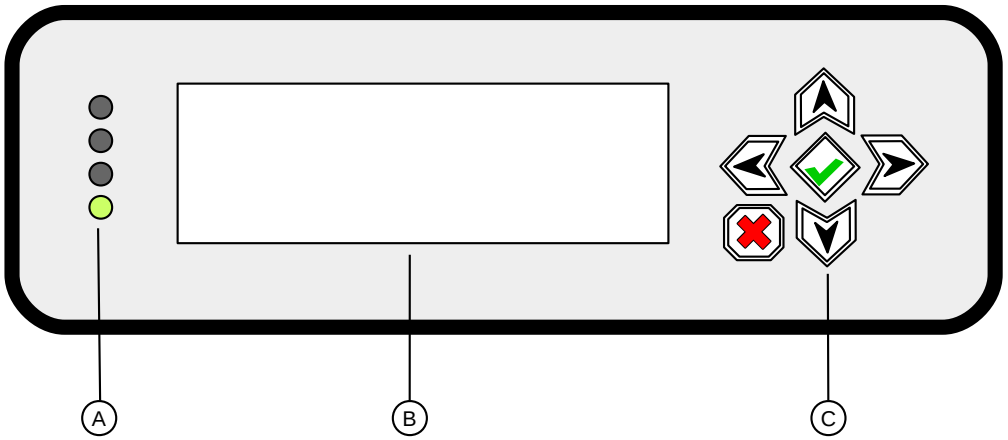


Figure 2.1: Front panel of the unit

Ⓐ Status LEDs

Ⓑ LCD display

Ⓒ Keypad

The top line of the LCD display shows UTC date and time. The date and

time displayed will typically only be accurate to 1 s. The contents of the second and third lines of the display depend on the display mode 2.1.2.

The bottom line is reserved for notification of system alarms and either shows 'System OK' or 'System Alarm'. The adjacent LED will be red if there is a running alarm. The other LEDs are currently unused.

2.1.1 Using the front panel keypad

The keypad provides access to status information and limited control and configuration of the unit. It can be used to cleanly shut down or reboot the computer without logging in.

System status is normally displayed on the screen. The menus are accessed by pressing any key. Menus are navigated using the keypad:

⮟	Move to next menu item
⮝	Move to previous menu item
⮞, ✔	Select menu item
⮜	Back to previous menu
✖	Back to the status display

Escaping back to the status page after making a change will not undo the change. Where a sub-menu lists a number of options, the currently selected option is flagged with an asterisk.

Dialogs are navigated using the cursor keys. A dialog will typically consist of a number of input fields. Some of these work like buttons and are selected using the ✔ key; others may require inputting a value and this is done by cycling through the possible values with the cursor keys.

If you move out of an input field, focus will pass to the next valid input field.

You can quit a dialog using the ✖ key. Any changes made in a dialog will not be applied if you quit it.

If a menu or dialog has been inactive for more than 5 minutes, the display returns to showing system status.

2.1.2 Menus

The menu structure is shown below:

LCD setup

The intensity and contrast of the LCD display can be set using this menu. A timeout can also be set on the backlight.

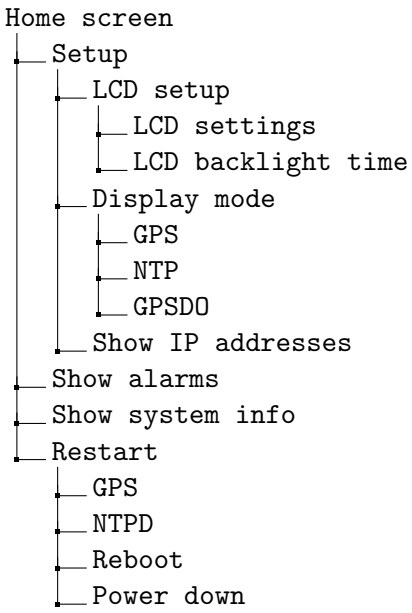


Figure 2.2: Menu structure

Display mode

The status information displayed by the unit in the second and third lines of the LCD display can be selected as relating to either GPS, NTP or the GPSDO.

When in GPS mode, the identifiers of up to 10 currently visible GPS space vehicles are displayed.

When in NTP mode, the second line shows the number of NTP packets received per minute. The third line shows information about synchronization status, including leap second announcements.

In GPSDO mode, the second line shows whether the GPSDO is locked or not. The third line alternates between the 'health' byte (**??**), and the estimated fractional frequency error (reported by the GPSDO) and the electronic frequency control (EFC) voltage, normalized to a maximum of 100.

Show alarms

This shows any currently running alarms as listed in `/home/cvgps/logs/alarms`.

Show system info

This displays version and serial number information and the make of the installed oscillator. This information is read from the file `/usr/local/etc/sysinfo.conf`

which has to be manually updated if the installed oscillator is changed.

Restart

This allows the user to restart several processes (GPS common view logging and `ntpd`) as well as reboot or power down the unit. You will be asked to confirm power down or reboot.

2.2 The rear panel

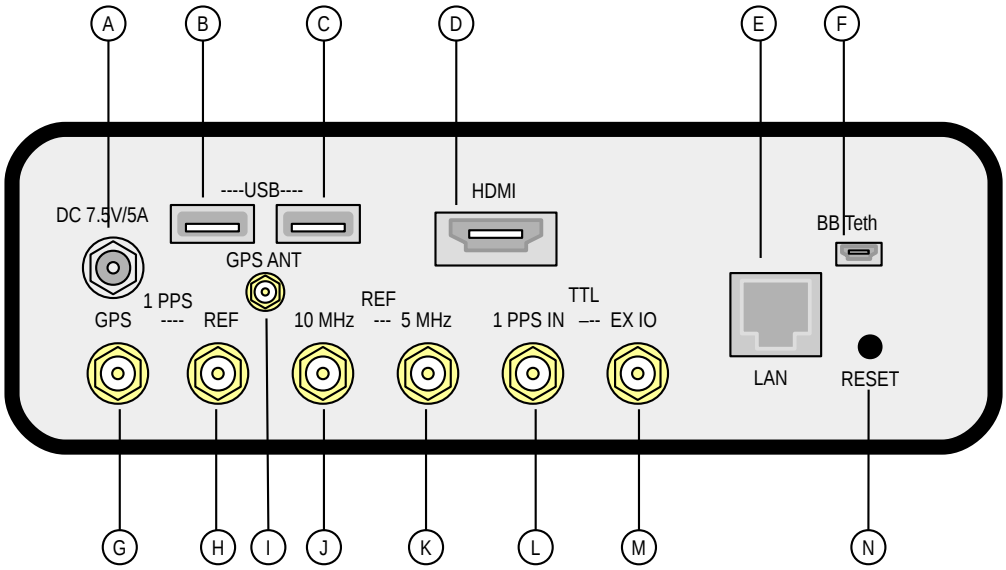


Figure 2.3: Rear panel of the unit

If connected to a computer via the USB connector Ⓕ, a network adapter should show up on the computer. The TTP will provide your computer with an IP address of either 192.168.7.1 or 192.168.6.1, depending on the type of USB network adapter supported by your computer's operating system. The TTP will reserve 192.168.7.2 or 192.168.6.2 for itself. Further information can be found in the BeagleBone Black documentation.

2.3 Installation

2.3.1 Operating environment

The TTP is designed for indoor use only and is neither water nor moisture-proof. It should not be subjected to large mechanical shocks or excessive heat and dust.

2.3.2 Install the GPS antenna and cable

The unit supplies 5 V DC to the antenna. This can be changed to 3.3 V via a jumper J1. More details are given in 3.1.

The GNSS antenna should be installed in a location with a clear view of the sky above 10°. All exposed connections should be weatherproofed. Make sure that all connections are tight but do not apply excessive torque as this can result in connectors detaching from the cable.

	Function	Connector	Signal characteristics
Ⓐ	DC power input		7.5 V, 5A
Ⓑ	USB		
Ⓒ	USB		
Ⓓ	Video	HDMI	
Ⓔ	Network	RJ45	
Ⓕ	BB USB network		
Ⓖ	GPS 1 pps OUT	SMA	5V DC supplied
Ⓗ	Reference 1 pps OUT	SMA	
Ⓘ	GPS antenna	SMB	
Ⓙ	Reference 10 MHz OUT	SMA	
Ⓚ	Reference 5 MHz OUT	SMA	
Ⓛ	1 PPS IN	SMA	TTL
Ⓜ	General purpose I/O	SMA	TTL
Ⓝ	Beaglebone Black reset		

Table 2.1: Rear panel electrical connections

A strain relief bulkhead is used for making the connection to the short 'N'-terminated cable.

2.3.3 Make other system connections

Network connection

A network connection is not required for operation as a time-transfer system but may be useful to the user for maintenance and downloading data files. Otherwise, a keyboard and monitor can be plugged in.

For operation as an NTP server, the unit will require a network connection. The unit can operate using DHCP or with a static IP address. The default is to use DHCP. The configured address can be conveniently found using the front panel menu.

A static IP can be set by using the utility `connmanctl` or by editing the file `/etc/network/interfaces`.

Keyboard and monitor

A HDMI monitor and USB keyboard and mouse can be used with the TTP. However, this only allows a console login 2.4. The graphical login and desktop environment normally available have been disabled to reduce memory usage.

Time and frequency signals

Specifications of the various output signals are given in 3.3.

2.4 Logging in

The TTP runs under Debian Linux. The desktop environment normally available has been disabled to reduce memory usage. Familiarity with a command-line Linux environment is therefore essential for operating and maintaining the TTP. It is beyond the scope of this manual to provide a Linux tutorial. The reader should consult one of the many online resources that exist.

Login is via the user `cvgps` (this name is used for historical reasons). The default password is supplied separately and you should change this after logging in.

2.5 The cvgps user

The `cvgps` user is the account used to log and process data.

It contains the following standard directories, some of which are mounted on the SSD.

```
/home/cvgps
├── bin ..... executables
├── etc ..... configuration files
├── cggtts
├── logs
│   └── alarms
├── raw ..... data files from the receiver, counter, and GPSDO
├── rinex
└── tmp
```

Figure 2.4: Directories in the `cvgps` account

Automatic operation is managed through the `cvgps crontab` file 5.2.

2.6 Checking operation

Upon startup, a number of alarms may be produced. All alarms should clear within five minutes of startup. Information on alarms and troubleshooting hints are given in **??**. Troubleshooting will require logging into the system (2.4).

remote	refid	st	t	when	poll	reach	delay	offset	jitter

Table 2.2: Checking NTP operation

You can check that logging of GNSS and counter data is occurring by looking in the directory `/home/cvgps/raw`.

Processing of data takes place at UTC0015 daily. CGGTTS files will be placed in the `/home/cvgps/cggtts` directory.

The TTP is NTP-synchronized using the GPS receiver's time of day messages and its 1 pps. The TTP operates on UTC. NTP operation can be checked using the command `ntpq -p`. This should display

2.7 Local configuration

To produce CGGTTS files, the processing software needs accurate antenna coordinates. These can be obtained from the TTP receiver, using `nv08extract`. More accurate coordinates can be obtained by submitting RINEX observation files to an online processing service. In the case of single frequency observations, the NRCAN PPP service can be used.

2.8 Securing the system

2.9 Maintenance

2.9.1 Updating the software

Debian Linux is updated separately from the OpenTTP software.

Updating the kernel is a separate procedure.

Updating the OpenTTP software is most conveniently done via the git repository.

2.9.2 Replacing the SD card

To replace the SD card, remove the screws from the front, remove the front panel and disconnect the cable connected to the LCD unit. Remove the screws at the rear and slide the electronics assembly out. You can remove the SD card without fully removing the electronics. Insert the new card and reassemble taking care to align the printed circuit boards with the slots in the enclosure.

3. The reference platform hardware

This chapter provides a more detailed description of the reference platform hardware.

3.1 Antenna

The DC voltage supplied to the antenna is selectable as either 3.3 or 5 V with the jumper J1. The default is 5 V. Short circuit protection is provided via the 1Ω fusible resistor R25.

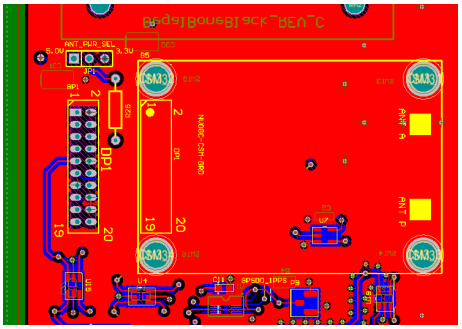
The NV08C-CSM has two antenna inputs ANT-A (active) and ANT-P (passive). When the antenna is connected to ANT-P (default setting) the external DC power supply is used. If the antenna is connected to ANT-A, the NV08-CSM board supplies 3.3 V DC and short circuit protection is provided by the board.

3.2 Multi-channel counter/timer

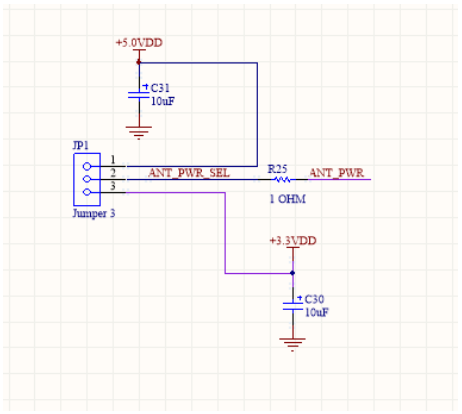
The OpenTTP reference platform uses an Opal Kelly XEM6001 FPGA (Xilinx Spartan 6 LX16) development board to provide a multi-channel counter. The counter is clocked at 200 MHz, so the full-range resolution is 5 ns. This is adequate for the applications envisaged for the OpenTTP system.

Although the counter has six channels, only three (FIXME four?) are connected in the current design 3.2. They are all configured with the system reference as START, with the exception of Channel 5. This is configured with the externally input 1 pps as START, and the time-transfer receiver's 1 pps as STOP. This is to allow time-transfer for an external reference.

The XEM6001 has eight LEDS which may aid in fault-finding 3.1. In particular, the presence of 1 pps signals can be readily seen (the pulses are



(a) Location of JP1



(b) JP1 voltages

Figure 3.1: Selection of antenna voltage using JP1

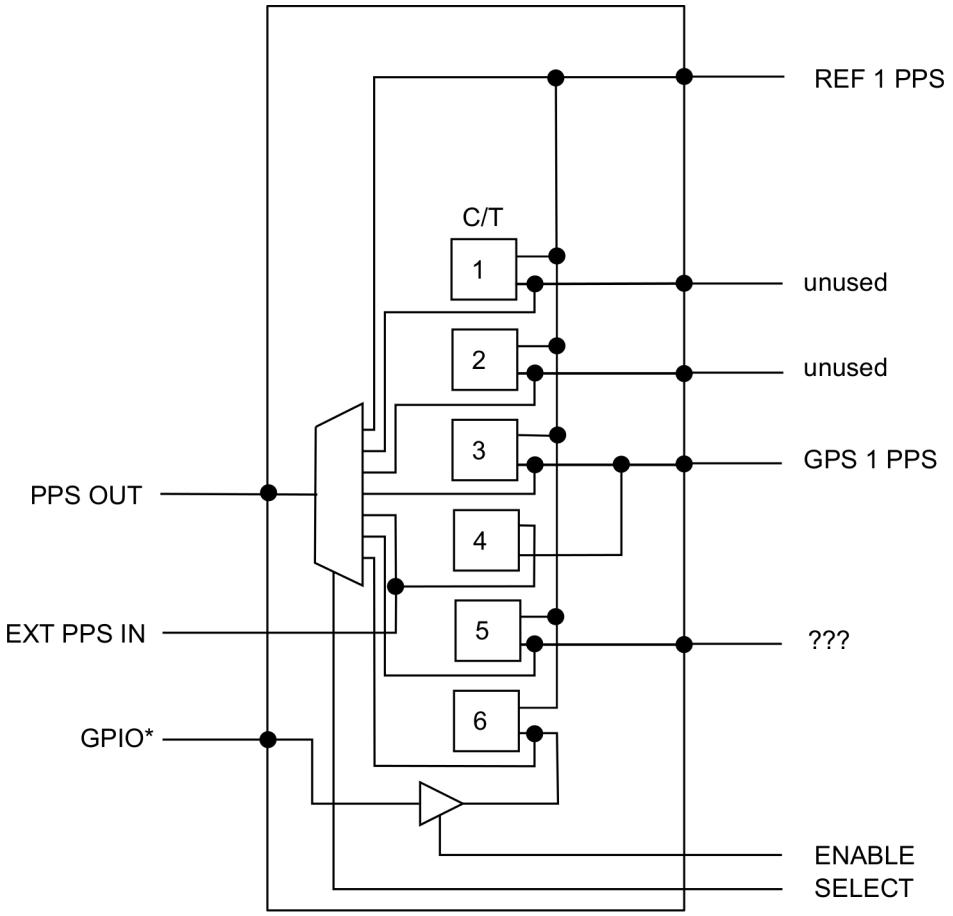


Figure 3.2: The OpenTTP multi-channel counter.

extended so that they are visible) and the lock state of the PLL producing the 200 MHz clock.

3.2.1 Counter delays

Differential delays, measured with respect to the system 1 pps, were measured by applying signals at the input of the FPGA.

3.3 Electrical specifications

LED	function
1	channel 1 pps (unused)
2	channel 2 pps (unused)
3	channel 3 pps (GPS receiver)
4	channel 4 pps (external pps)
5	channel 5 pps (unused)
6	channel 6 pps (GPIO)
7	GPIO enabled
8	Digital Clock Manager PLL is locked

Table 3.1: Status LEDs on Opal Kelly XEM6001 board

channel	delay (ns)
1	TBA
2	TBA
3	TBA
4	TBA
5	TBA
6	TBA

Table 3.2: XEM6001 counter delays

GPS 1 pps out
Reference 1 pps out
Reference 10 MHz out
Reference 5 MHz out
1 pps in
General purpose I/O

Table 3.3: Electrical signals and their characteristics

4. Installing the software

4.1 Installation requirements

You will need a basic Linux development environment, including C/C++ compilers, Perl and python3. You will likely need the development packages for:

`boost` C++ libraries
`libgsl` GNU scientific library

You may also need:

`Time::HiRes` Perl library

At present, both Perl and python3 scripts are used in OpenTTP. All new script development is in python3. Eventually, all of the Perl scripts still in active use (other than those supporting obsolete devices) will be replaced with python3 scripts.

The python3 scripts generally don't require any exotic libraries but you may still need to install some extra python libraries, in particular if you are installing into a minimal environment.

The above requirements are by no means comprehensive. What you will need to install will depend very much on the Linux distribution you are using.

4.2 Obtaining, building and installing the software

The OpenTTP software is obtained from the git repository hosted by GitHub. There are two main branches, the 'master' and 'develop' branches. The 'develop' branch is generally stable, but may occasionally be broken.

Clone the repository

```
git clone https://github.com/openttp/openttp.git
```

change directory to the repository and then check out the branch you want to use

```
git checkout develop
```

4.2.1 Building the documentation

The documentation is written in LaTeX and uses some packages and fonts that are generally packaged as 'extras' and will probably need to be installed. The various packages used can be inspected in the file `doc/manual/OpenTTPManual.tex`. To build the documentation as a PDF, change directory to `doc/manual` and run `make`.

4.2.2 Installing the software

A scripts is provided for building and installing the software.

```
software/system/installsys.py
```

The installer has been used with RedHat Enterprise Linux, CentOS, Ubuntu and Debian (on the BeagleBone Black).

`installsys.py` must be run first (with superuser privileges), because it installs libraries which are needed by the GPSCV software.

`installsys.py` can also be used to install various targets individually. Run `installsys.pl -h` to see the options available. This may be helpful when trying to resolve problems with building the software.

`install.py` will archive any existing scripts and binaries, and create any directories it needs in the current user's home directory. Run `install.py -h` to see the options available. One useful option is the capability to install individual targets.

4.3 A minimal software setup

For users who wish to use their own hardware, this section describes the minimum setup required for operation.

The OpenTTP software distribution is comprised of various C/C++ applications and Perl and python scripts. As a minimum, you will need:

`TFLibrary.pm`, a Perl module for commonly used tasks, such as reading configuration files
`ottplib.py`, the `python` version of `TFLibrary.pm`
`libconfigurator`, a C library for parsing configuration files
`lockport`, a utility to create a UUCP lock file
`mktimetx`, to create time-transfer files

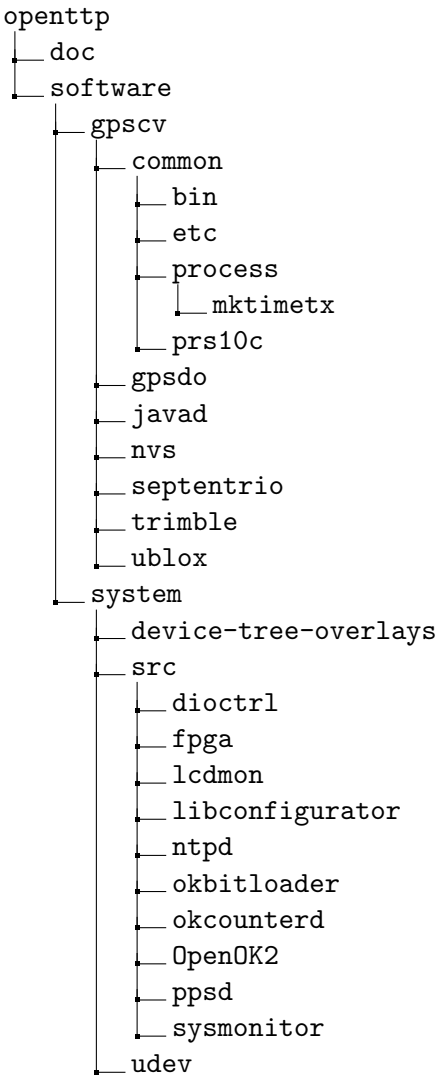


Figure 4.1: Overview of the OpenTTP software source

one of the OpenTTP-provided scripts to log your receiver
one of the OpenTTP-provided scripts to log your counter/timer

You must use one of the OpenTTP receiver logging scripts with your GNSS receiver because `mktimetx` expects a custom file-format 5.4. In particular, the receiver's native binary formats are not readable by `mktimetx`. Similarly, OpenTTP uses a custom file format for the counter-timer measurement files, although in this case, conversion from another format will probably be straight-forward. Most likely, users will have to provide their own software for logging their counter/timer, given the large number of possible devices here, and the limited support within OpenTTP.

You may also find the following useful:

`kickstart.py` for automatic start of logging processes
`runmktimetx.pl` for automated processing, and reprocessing of time transfer data files
`gziplogs.py` for managing log file compression

4.4 Common configuration problems

4.4.1 UUCP lock file creation

UUCP lock files are used to prevent non-OTTP processes from opening serial ports while they are in use. You need to set the location for lock file creation specific to the operating system, and ensure that the OTTP user (cvgps typically) has the right permissions to write to this location. This is typically achieved by adding the user to the appropriate group. For example, on Ubuntu 18 the lock directory is `/var/lock`. In this case, the directory is world writeable, so the OTTP user does not need to belong to any supplementary groups.

5. GPSCV software

This chapter describes software related to GPSCV time-transfer.

5.1 Software overview

Time-transfer files are produced by `mktimetx` from the GNSS receiver logs and counter/timer measurements. The time-transfer files are in RINEX observation and CGGTTS format. Currently, CGGTTS-format files are only produced for GPS. Figure **??** illustrates the processing chain TODO.

The OpenTTP software suite is catalogued in Table 5.1

5.2 crontab

Automatic logging, processing and archival of data is co-ordinated via the user `cvgps`' `crontab`.

A minimal `crontab` for the user `cvgps` looks like this:

```
# Check that all logging is running every 5 minutes
*/5 * * * * /usr/local/bin/kickstart.pl # See ~/etc/
    ↪ kickstart.conf

# Run the processing of the data at 00:15
15 0 * * * nice $HOME/bin/runmktimetx.pl >/dev/null 2>&1

# Give the processing some time to complete, then zip the
    ↪ files at 00:45
45 0 * * * nice $HOME/bin/gziplogs.pl >/dev/null 2>&1

# Check the status of the system once a day, just before
    ↪ the day rollover
56 23 * * * $HOME/bin/checkstatus.pl >$HOME/
    ↪ lockStatusCheck/status.dat
```

	program	
Data processing	mktimetx	core program
	runmktimetx.pl	
	mkcggts.py	
	rnx2cggtts	
TIC logging	hp5313xlog.pl	
	ks53230log.py	
	cnt9xlog.py	
	okxemlog.pl	
	prs10log.pl	
	ticclog.py	
GNSS receiver logging	jnslog.pl	Javad
	nv08log.pl	NVS
	plrxlog.py	Septentrio
	restlog.pl	Trimble Resolution T
	ublox9log.py	ublox
	ubloxlog.pl	ublox
GNSS receiver utilities	jnsextract.pl	
	nv08extract.pl	
	nv08info.pl	
	restextract.pl	
	restinfo.pl	
	ubloxextract.py	
	ubloxmkdev.py	
Analysis tools	cggttsqc.py	
	cmpcggtts.py	
	editcggtts.py	
	editrnxnav.py	
	editrnxobs.py	
	ticqc.py	
Miscellaneous	log1Wtemp.pl	

Table 5.1: GPSCV software overview

showing the three essential processes of logging, processing and archival of data.

The active crontab can be examined with the command `crontab -l`. A default `crontab` is saved in `/home/cvgps/etc/crontab`.

5.3 Configuration file format

Configuration files use a common format and are plain text files, designed to be easily edited via a command-line editor because in many applications, only shell access to the system will be available.

The file is usually divided into sections, with section names delimited by square brackets [ ]. Entries in each section are of the form:

```
key = value
```

For example,

```
[Receiver]
manufacturer = Trimble
model = Resolution T
```

defines a section `Receiver` and the two keys: `manufacturer` and `model`.

The notation `Section::Key` is used to fully specify keys. For example, `Receiver::model` and `Receiver::manufacturer` specify the two keys above.

Keys and section names are not case-sensitive. In particular, the python and Perl libraries which provide functions for reading the configuration files convert keys and section names to lower case. The case of key values is preserved, since this may be signficant eg path names.

Leading and trailing whitespace is removed from keys, key values and section names.

Comments begin with a '#'.

Some keys define a list of sections. For example, the comma-separated list of values for `CGGTTS::outputs`

```
[CGGTTS]
outputs = c1-code,p1-code,p2-code
```

defines three sections: `c1-code`, `p1-code`, and `p2-code`. This is a bodge which would be more elegantly addressed using an extensible format like XML, but it has proven to be sufficient for our needs.

5.3.1 Paths

Paths to files specified in a configuration file are constructed with the following precedence:

1. If the path begins with a leading slash, then it is interpreted as an absolute path
2. If a non-absolute path is specified, it is interpreted as being relative to the users's home directory (or where the configuration file allows specification of a different root path eg in gpscv.conf, relative to that root path)
3. Otherwise, the default path is used.

Most software in OpenTTP follows these conventions.

5.4 Data file formats

5.4.1 GPS receiver

This text file records messages from the GPS receiver. The native format of the messages can be a mix of ASCII and binary messages. Binary messages are hexadecimal-encoded for saving in the log file. Some logging scripts record ancillary information, such as commands sent to the receiver. Comments in the log file are allowed, prefaced by a '#' character. The '@' character is used to tag lines containing special information that needs to be parsed by the processing software.

Messages are successive lines of the form:

```
<message_id> <time_stamp> <message>
```

Example:

```
T0 00:00:02 cdfbc75a9a8c353fc5
```

Hex encoding of binary messages results in much larger files but these compress to a size not much larger than the original binary data.

The exception to this is the Septentrio logging script, which uses the native SBF format. Some logging scripts have the option of logging data in the receiver's native format, to facilitate use of other tools.

5.4.2 Time-interval counter

This text file records the difference between GNSS receiver and the Reference Oscillator 1 pps, measured each second. The convention is that the Reference oscillator provides the start trigger. Entries are successive lines of the form:

Section	Key
Antenna	antenna number, antenna type, delta H, delta N, delta E, frame, marker name, marker number, X, Y, Z
CGGTTS	BIPM cal id, comments, create, ephemeris, ephemeris file, ephemeris path, internal delay, lab id, maximum DSG, minimum elevation, minimum track length, naming convention, outputs, reference, receiver id, revision date, version, code, constellation, path
Delays	antenna cable, reference cable
Counter	file extension, GPIB address, header generator, lock file, logger, logger options, okxem channel, port
Misc	gzip
Paths	CGGTTS, counter data, processing log, receiver data, RINEX, tmp
Receiver	configuration, elevation mask, logger, logger options, manufacturer, model, observations, port, pps offset, synchronization, pps synchronization delay, status file, timeout, version
Reference	file extension, logging interval, log path, log status, oscillator, power flag, status file
RINEX	agency, create, observer, version

Table 5.2: Summary of `gpscv.conf` entries

```
<time_of_day> <time_difference>
```

where the time difference is in seconds.
Example:

```
00:00:04 +4.0821E-006
```

5.5 gpscv.conf - the core configuration file

A single configuration file, `gpscv.conf`, provides configuration information to most of the OpenTTP software. `gpscv.conf` is used by `mktimetx`, receiver logging scripts, TIC logging scripts,receiver utilities and so on.

It uses the format described in 5.3.

5.5.1 [Antenna] section

Entries used to create the RINEX header are:

- antenna number
- antenna type

- □ delta H, delta E, delta N
- □ marker name
- □ marker number
- □ X,Y,Z

Entries used to create the CGGTTS header are:

- □ X,Y,Z

antenna number
This appears as ANTNUM in the RINEX header.
Example:

```
antenna number = A567456
```

antenna type
This appears as ANTTYPE in the RINEX header.
Example:

```
antenna type = Ashtec
```

delta H
This appears as DELTA H in the RINEX header.
Example:

```
delta H = 0.0
```

delta E
This appears as DELTA E in the RINEX header.
Example:

```
delta E = 0.0
```

delta N
This appears as DELTA N in the RINEX header.
Example:

```
delta N = 0.0
```

frame
This appears as FRAME in the CGGTTS header.
Example:

```
frame = ITRF2010
```

marker name
This appears as MARKER NAME in the RINEX header.
Example:

```
marker name =
```

marker number
This appears as MARKER NUMBER in the RINEX header.
Example:

```
marker number =
```

X
This appears as X in the CGGTTS header and APPROX POSITION XYZ in the RINEXheader.
Example:

```
X = +4567890.123
```

Y
This appears as Y in the CGGTTS header and APPROX POSITION XYZ in the RINEXheader.
Example:

```
Y = +2345678.90
```

Z
This appears as Z in the CGGTTS header and APPROX POSITION XYZ in the RINEXheader.
Example:

```
Z = -1234567.890
```

5.5.2 [CGGTTS] section

Entries in this section control the format and content of CGGTTS files and filtering applied to CGGTTS tracks in the final output.

To create CGGTTS output you must enable it:

outputs
This defines a list of sections which in turn define the desired CGGTTS outputs.
Example:

```
outputs = CGGTTS-GPS-C1,CGGTTS-GPS-P1,CGGTTS-GPS-P2
```

A CGGTTS v2E header looks like:

```
CGGTTS GENERIC DATA FORMAT VERSION = 2E
REV DATE = 2018-03-20
RCVR = NVS NV08 undefined 1999 mktimetx,v0.1.4
```

```
CH = 32
IMS = 99999
LAB = NMIA
X = -4648239.852 m
Y = +2560635.623 m
Z = -3526317.023 m
FRAME = ITRF2008
COMMENTS = none
INT DLY = 0.0 ns (GPS C1) CAL_ID = none
CAB DLY = 0.0 ns
REF DLY = 0.0 ns
REF = UTC(AUS)
CKSUM = 1A
```

Entries in the header than can be defined in the CGGTTS section are as below.

comments
This defines a single COMMENTS line in the CGGTTS header. The output line will be truncated at 128 characters.
Example:

```
comments = none
```

lab
This defines the LAB line.
Example:

```
lab = NMI
```

reference
This defines REF in the CGGTTS header.
Example:

```
reference = UTC(XXX)
```

revision date
This defines REV DATE in the CGGTTS header. It must be in the format YYYY-MM-DD.
Example:

```
revision date = 2015-12-31
```

create
This defines whether or not CGGTTS files will be generated by `mktimetx`.
Example:

```
create = yes
```

ephemeris
This defines whether to use the receiver-provided ephemeris or a user-provided ephemeris (via a RINEX navigation file). If a user-provided ephemeris is specified then `ephemeris path` and `ephemeris file` must also be specified.
Example:

```
ephemeris = receiver
```

ephemeris file
This specifies a pattern for user-provided RINEX navigation files. Currently, only patterns of the form `XXXXddd0.yyn` are recognized.
Example:

```
ephemeris file = brdcddd0.yyn
```

ephemeris path
This specifies the path to user-provided RINEX navigation files.
Example:

```
ephemeris path = igsproducts
```

lab id
This defines the two-character lab code used for creating BIPM-style file names, as per the V2E specification.
Example:

```
lab id = AU
```

maximum DSG
CGGTTS tracks with DSG lower than this will be filtered out. The units are ns.
Example:

```
maximum DSG = 10.0
```

minimum elevation
CGGTTS tracks with elevations lower than this will be filtered out. The units are degrees.
Example:

```
minimum elevation = 10
```

minimum track length
CGGTTS tracks shorter than this will be filtered out. Tracks meeting the criterion are not necessarily contiguous. The units are seconds.
Example:

```
minimum track length = 390
```

maximum URA
GPS ephemerides with URA greater than this will not be used. They will still be written to RINEX navigation files, however.
Example:

```
maximum URA = 3.0
```

naming convention
Defines the CGGTTS file naming convention. Valid options are 'plain' (MJD.cctf) and 'BIPM' styles. The `lab id` and `receiver id` should be defined in conjunction with BIPM-style filenames.
Example:

```
naming convention = BIPM
```

receiver id
This defines the two-character receiver code used for creating BIPM-style file names, as per the V2E specification.
Example:

```
receiver is = 01
```

version
This defines the version of CGGTTS output. Valid versions are v1 and v2E. The `lab id` and `receiver id` should be defined in conjunction with v2E ouput
Example:

```
version = v2E
```

CGGTTS output sections

Multiple CGGTTS outputs can be defined, allowing for different constellation and signal combinations. An example of a CGGTTS output section is as follows:

```
[CGGTTS-GPS-C1]
constellation=GPS
code=C1
path=cggtts
BIPM cal id = none
internal delay = 11.0
```

BIPM cal id
This defines CAL_ID for the internal delay, as used in v2E CGGTTS headers.
Example:

CGGTTS name	RINEX name
C1	C1C
P1	C1P
E1	C1C
B1	C2I
C2	C2C
P2	C2P
B2	C7I

Table 5.3: Correspondence of CGGTTS and RINEX signal names.

```
BIPM cal id = none
```

code

CGGTTS codes can be specified using either the two letter code, for example 'C1' as described in the CGGTTS V2E specification, or three letter RINEX v3.03 observation codes. *Example:*

```
code = P1+P3
```

constellation
This defines the GNSS constellation. Only GPS is supported currently for CGGTTS generation.
Example:

```
constellation = GPS
```

internal delay
This defines INT DLY in the CGGTTS header. The units are ns.
Example:

```
INT DLY = 0.0
```

path
This defines the directory in which output files are placed.
Example:

```
path = cggtts
```

In v1 CGGTTS files, the delays are specified via INT DLY, CAB DLY and ANT DLY. For v2E files, the delays may be specified via the 'system delay' and 'total delay'. If multiple delays (eg both internal and system delay are present) are defined in `gpscv.conf`, the precedence order is internal, system and then total delay.

The entries used to specify system and total delay are:

system delay
This defines SYS DLY in the CGGTTS header. The units are ns.
Example:

```
SYS DLY = 0.0
```

total delay
This defines TOT DLY in the CGGTTS header. The units are ns.
Example:

```
TOT DLY = 0.0
```

5.5.3 [Counter] section

file extension
This defines the extension used for time interval measurement files. The default is 'tic'.
Example:

```
file extension = tic
```

configuration
This sets a configuration file for the counter. Its contents are defined by the calling script. In the case of HP5313x counters for example, it lists SCPI commands sent to initiliaze the counter.
Example:

```
configuration = etc/hp53131.conf
```

flip sign
The processing software eg `mktimetx` assumes that TIC measurements are started by the reference and stopped by the GNSS receiver. If you need to invert the sign of the measurements, set the option 'flip sign' to 'yes',
Example:

```
flip sign = no
```

GPIB address
For GPIB devices, the GPIB address must be defined.
Example:

```
GPIB address = 3
```

GPIB converter
This defines the GPIB interface converter (eg RS232 to GPIB). Currently

the only valid values is 'Micro488'.
Example:

```
GPIB converter = Micro488
```

header generator
A header for the log file can be optionally added to the log file, using the output of a user provided script. Output should be to `stdout`. Each line will have a "#" automatically prepended to it.
Example:

```
header generator = bin/myticheader.pl
```

lock file
This defines the device lock file, used to prevent multiple instances of the logger from being started.
Example:

```
lockfile = okxem.gpscv.lock
```

logger
This defines the counter logging script.
Example:

```
logger = okxemlog.pl
```

logger options
This defines options passed to the counter logging script.
Example:

```
logger options =
```

mode
This defines the operating mode of the counter. Valid values are `timestamp` and `time interval` Currently, this is only used by the TAPR TICC.
Example:

```
mode = timestamp
```

okxem channel
The OpenTTP counter is multi-channel so the channel to use (1-6) must be specified.
Example:

```
okxem channel=3
```

port
This defines the port used to communicate with the counter. It's value

depends on the type of counter. For the XEM6001, it's a Unix socket. For serial devices, it's a device name like `/dev/ttyUSB0`.
Example:

```
# this is the port used by okcounterd
port = 21577
```

timestamp format
This controls the format of timestamps used in the counter log file. Valid values are `unix` and `time of day`. Currently, this is only used by the TAPR TICC.
Example:

```
timestamp format = time of day
```

5.5.4 [Misc] section

gzip
Defines the compression/decompression program used in conjunction with counter and receiver log files.
Example:

```
gzip = /bin/gzip
```

5.5.5 [Delays] section

antenna cable
This is ANT DLY as used in the CGGTTS header. Units are ns.
Example:

```
antenna cable = 0.0
```

reference cable
This is REF DLY as used in the CGGTTS header. Units are ns.
Example:

```
reference cable = 0.0
```

5.5.6 [Paths] section

Paths follow the rules described in .

root
Defines the root path to be used with all other paths, unless they are specified as absolute paths. As with other paths specified in `gpscv.conf`, it is interpreted as being relative to the user's home directory, unless prefaced with a '/'.
Example:

```
root = test/newreceiver
```

CGGTTS
Defines the default directory used for CGGTTS files. This is typically overridden by the output directory that can be defined in each CGGGTS output section.
Example:

```
CGGTTS = cggtts
```

counter data
Defines the directory used for TIC data files.
Example:

```
counter data = raw
```

processing log
Defines the directory where the `mktimetx` processing log is written.
Example:

```
processing log = logs
```

receiver data
Defines the directory used for GNSS receiver raw data files.
Example:

```
receiver data = raw
```

RINEX
Defines the directory used for RINEX files.
Example:

```
RINEX = rinex
```

tmp
Defines the directory used for intermediate and debugging files.
Example:

```
tmp = tmp
```

onewire temp data
Defines the directory used to write temperature logs.
Example:

```
onewiretemp data = raw/onewire
```

uucp lock
Sets the directory used to write UUCP lock files. UUCP lock files are used

with serial devices to prevent other processes (eg `minicom`) opening the serial port while it is in use. The default is `/var/lock` but this varies with the operating system and its version so you will need to check this.
Example:

```
# This is for Debian
uucp lock = /var/run/lock
```

rinex l1l2
Defines the directory used to write RINEX files with all observations, typically so that precise antenna coordinates can be obtained. This is only used with dual frequency Javad receivers.
Example:

```
rinex l1l2 = rinex/l1l2
```

5.5.7 [Receiver] section

configuration
This specfies a file to be used to configure the receiver. Currently, it is only used with Javad receivers.
Example:

```
configuration = rx.cfg
```

elevation mask
This sets an elevation mask for tracking os satellites - below this elevation, satellites are ignored. The units are degrees. This may not be implemented for all receivers.
Example:

```
elevation mask = 0
```

file format
Data logged by the receiver can be logged in either OpenTTP format (‘ottp‘) or its native binary format (‘native‘). However, data logged in native format cannot presently be used by `mktimetx`.
Example:

```
file format = ottp
```

logger
This is the script used to configure and log messages from the GNSS receiver.
Example:

```
logger = jnslog.pl
```

logger options
These are options passed to the receiver logging script.
Example:

```
logger options =
```

manufacturer
This defines the manufacturer of the receiver. Together with the model and version, this sets how data from the receiver is processed. For a list of supported receivers see XX.
Example:

```
manufacturer = Javad
```

model
This is the receiver model.For a list of supported receivers see XX.
Example:

```
model = HE_GGD
```

version
This can be used to identify the firmware version in use, for example.
Example:

```
version = 2.6.1
```

observations
This is a list of GNSS systems which will be tracked by the receiver. In some applications where a multi-GNSS receiver is used, it may be desirable to track only one GNSS system so this sets which system is used. More generally, low-end multi-GNSS receivers are typically only capable of tracking certain combinations of GNSS systems so this is used to select the required combination. *Example:*

```
observations = GPS
```

port
This is the serial port used for communication with the receiver.
Example:

```
port = /dev/ttyS0
```

pps offset
This is an offset programmed into the GNSS receiver. Its purpose is to ensure that the counter triggers correctly, particularly HP5313x counters, which will only trigger every two seconds if the start trigger slips slightly behind the stop trigger. Suitable values are determined by the long-term stability of the reference, compared with GPS. The units are ns.
Example:

```
pps offset = 3500
```

pps synchronization
This is a Javad-specific option. The logging script will force a synchronization of the receiver's internal time scale with the input 1 pps.
Example:

```
pps synchronization = no
```

pps synchronization delay
This is a Javad-specific option. Synchronization of the receiver's internal time scale with the input 1 pps is delayed for this time after reset of the receiver. The units are seconds.
Example:

```
pps synchronization delay = 300
```

status file
The status file contains a summary of the current state of the receiver,tyically at least the currently visible GNSS satellites. Other software, for example `lcdmonitor`, uses this information.
Example:

```
status file = logs/rx.status
```

timeout
The logging script will time out and exit if no messages are received for this period.
Example:

```
timeout = 60
```

time-transfer
Receivers can be configured for non-time transfer operation. Typically, in this mode fewer messages are enabled and logged.
Example:

```
time-transfer = yes
```

sawtooth phase
This defines which pps the sawtooth correction is to be applied to. Valid values are 'current second', 'next second' and 'receiver specified'. 'Current' means for the pps just generated.
Example:

```
sawtooth phase = current second
```

year commissioned
The year the receiver was commissioned. This is used in the CGGTTS header.
Example:

```
year commissioned = 1999
```

5.5.8 [Reference] section

file extension
This defines the extension used for Reference status logs.
Example:

```
file extension = .rb
```

logging interval
This defines the interval between status file updates. The units are seconds.
Example:

```
logging interval = 60
```

log path
This defines where status logs are written to.
Example:

```
log path = raw
```

log status
This enables status logging of the Reference.
Example:

```
log status = yes
```

oscillator
This identifies the installed oscillator, so that device-specific handling can be implemented.
Example:

```
oscillator = PRS10
```

power flag
This defines the file used to flag that the Reference has lost power, and needs rephasing. Currently, this only has meaning for the PRS10. It is used ntpd to disable the refclock corresponding to the PRs10's 1 pps.
Example:

```
power flag = logs/prs10.pwr
```

status file
In the case of the PRS10, this consists of the six status bytes and sixteen ADC values.
Example:

```
status file = logs/prs10.status
```

5.5.9 [RINEX] section

Entries in this section control the format and content of RINEX files. RINEX observation and navigation files in version 2 and version 3 formats can be produced. RINEX observations

agency
This specifies the value of the AGENCY field which appears in RINEX observation file headers.
Example:

```
agency = MY AGENCY
```

create
This defines whether or not RINEX files will be generated.
Example:

```
create = yes
```

force v2 name
This forces a V2 name for V3 RINEX output.
Example:

```
force v2 name = no
```

observations
Normally, only code observations are output by mktimetx. To output phase observations, set this to 'all'.
Example:

```
observations = code
```

observer
This specifies the value of the OBSERVER field which appears in RINEX observation file headers. If the observer is specified as 'user' then the environment variable USER is used.
Example:

```
observer = user
```

version
This specifies the version of the RINEX output. Valid versions are 2 and 3.
Example:

```
version = 2
```

5.6 mktimetx

`mktimetx` is the core OpenTTP application. It creates CGGTTS and RINEX-format time-transfer files.

In the RINEX files, the code measurements have been corrected for any offsets between the raw measurements and the output 1 pps, and then the difference between the external clock and output pps (obtained from the TIC measurements) is applied ie the raw code measurements are reported with respect to the external clock.

5.6.1 usage

When run with no arguments, `mktimetx` uses the default GPSCV processing configuration file `~/gpscv.conf` and processes data from the preceding day.

The command line options are

--configuration <file> specify the configuration file
--debug <file> turn on debugging to `file`. To debug to `stderr`, just use 'stderr'.
--disable-tic disable the use of sawtooth-corrected counter/timer measurements
--help show help
-m <MJD> specify the mjd
--start <hh:hh:ss/hhmmss> set the start time
--stop <hh:hh:ss/hhmmss> set the stop time
--short-debug-message print out shorter debugging messages
--sv-diagnostics save raw measurements for each SV in a file. Each SV is in a separate file.
--timing-diagnostics save timing diagnostics in a file
--verbosity <n> set the level of debugging verbosity. Valid values are 1 to 4. A verbosity of 4 will create a file several hundred MB in size.
--version print version information and exit

Example:

```
mktimetx --configuration test.conf -m 57803 --debug stderr
    ↪  --verbosity 1
```

Section	Key
Antenna	antenna number, antenna type, *delta H*, *delta N*, *delta E*, frame, marker name, marker number, marker type, x, y, z
CGGTTS	*comments*, *create*, lab, lab id, *maximum dsg*, *minimum track length*,*naming convention*, outputs, receiver id, reference, revision date, version
Counter	*file extension*, *flip sign*
Delays	antenna cable, reference cable
Misc	*gzip*
Paths	cggtts, counter data, receiver data, *processing log*, rinex, *root*, tmp
Receiver	*file extension*, manufacturer, model, *observations*, pps offset, *sawtooth phase*, *version*
RINEX	agency, *create*, observer, version

Table 5.4: Summary of `gpscv.conf` entries used by `mktimetx`. Optional entries are italicised.

runs `mktimetx` in debugging mode, writing to `stderr` using the configuration file `test.conf` and processing data for MJD 57803.

5.6.2 configuration file

`mktimtex` uses `gpscv.conf`. Keys used by it are listed in table 5.4.

5.6.3 log file

5.7 runmktimetx.pl

`runmktimetx.pl` provides a convenient way to process multiple days of data and to run any missed processing.

`runmktimetx.pl` uses `gpscv.conf`. There are no entries in `gpscv.conf` specific to `runmktimetx.pl`

`runmktimetx.pl` doesn't produce a log file.

5.7.1 usage

`runmktimetx.pl` is normally run as a `cron` job.

To run `runmktimetx.pl` on the command line, use

```
runmktimetx.pl [option] ... [Start MJD [Stop MJD]]
```

`Start MJD` and `Stop MJD` specify the range of MJDs to process. If a single MJD is specified, then data for that day is processed. If no MJD is specified, the previous day's data is processed.

The options are:

-a <file> extend check for missed processing back `n` days (the default is 7)
-c <file> use the specified configuration file
-d run in debugging mode
-h print help and exit
-x run missed processing
-v print version information and exit

5.8 mkcggtts.py

`mkcggtts.py` is used for scripting the generation of CGGTTS files from RINEX navigation and observation files using a third party tool. Currently, the only tool supported is `r2cggtts`. It will default to `rnx2cggtts`, when this matures.

5.8.1 usage

```
mkcggtts.py [OPTION] ... [mjd [mjd ...]]
```

The command line options are:

--help,-h print the help information and exit
-–config <file>, -c <file> use the specified configuration file
--debug,-d print debugging information to stderr
--leapsecs <n> set the number of leap seconds
--previousmjd when no MJD (or one MJD) is given, MJD-1 is added to the MJDs to be processed
--version,-v show the version information and exit

The leap second count in `paramCGGTTS` is determined from the RINEX navigation file if possible. Otherwise, it can be specified manually via the `--leapsecs` option.

The `--previousMJD` option is intended to be used in automated daily processing using `r2cggtts`, to reprocess data for any missed track at the end of the day.

5.8.2 configuration file

See the sample!

5.8.3 examples

None yet!

5.9 rnx2cggtts

`rnx2cggtts` generates CGGTTS files from RINEX observation and navigation files. Currently, it will only generate CGGTTS from GPS measurements. RINEX files must be version 3.

CGGTTTS outputs have been compared with the output of `r2cggtts`. Known differences are:

1. Occasionally, a different IODE will be chosen. When comparing CGGTTS between r2cggtts and rnx2cggtts, tracks should be matched on IODE, otherwise there will be outliers at the 5 to 10 ns level.
2. In P3 files, MDIO is modelled ionosphere, and not MSIO
3. Satellite ELV and AZM are evaluated from a fit to the trajectory, rather than the middle point from the data set for a track.

5.9.1 usage

To run `kickstart.py` on the command line, use:

```
rnx2cggtts [option] ...
```

The command line options are:
–**configuration FILE, -c FILE** use the specified configuration file
–**debug FILE, -d FILE** print debugging infomration to file-
–**shorten** shorten debugging messages
–**verbosity <n>** set debugging verbosity
–**help, -h** show help and exit
–**licence** show the software licence and exit
–**version, -v** print version information and exit

5.9.2 configuration file

The configuration file is similar to `gpscv.conf`. A minimal configuration file for P3 output is:

```
[RINEX]
station = MOST01AUS

[Antenna]
X = -4648240.85
Y = +2560636.45
```

```
Z = -3526317.79

[CGGTTS]
outputs = CGGTTS-GPS-P3

[GPS delays]
kind = internal
codes = C1C,C1W,C2W
delays = 0.0,0.0,0.0
BIPM cal id = UNCALIBRATED

[CGGTTS-GPS-P3]
constellation=GPS
code=C1W+C2W
path=cggtts

[Paths]
rinex observations = RINEX
rinex navigation = RINEX
```

[RINEX] section

station
This the RINEX station name. Both V2 (4 characters) and V3 (9 characters) are allowed. The station name is used to construct RINEX file names. Currently, these files are expected to be decompressed.
Example:

```
station = MOST01AUS
```

[Antenna] section

X,Y,Z
These are the ECEF antenna coordinates, in metres. They are used in the calculations and are written to the CGGTTS header.
Example:

```
X = -4648240.85
Y = +2560636.45
Z = -3526317.79
```

frame
This is the reference frame applicable to the antenna coordinates. It is only used in the CGGTTS header and is optional.
Example:

```
frame = ITRF2014
```

[Receiver] section

manufacturer
This is identifies the manufacturer of the GNSS receiver. It is only used in the CGGTTS header in the RCVR line and is optional.
Example:

```
manufacturer = Septentrio
```

model
This identifies the GNSS receiver model. It is only used in the CGGTTS header in the RCVR line and is optional.
Example:

```
model = mosaic-T
```

serial number
This identifies the GNSS receiver serial number. It is only used in the CGGTTS header in the RCVR line and is optional.
Example:

```
serial number = 123456
```

commissioning year
This identifies year the GNSS receiver started operation. It is only used in the CGGTTS header in the RCVR line and is optional.
Example:

```
commissioning year = 2022
```

channels
This identifies the number of receiver channels. It is only used in the CGGTTS header and is optional.
Example:

```
channels = 768
```

[CGGTTS] section

outputs
This is a comma-separated list of CGGTTS output sections. Each item in the list must have a corresponding section.
Example:

```
outputs = CGGTTS-GPS-P3
```

version
This is the CGGTTS version. Only V2E is supported at present. The version is optional and the default is V2E.
Example:

```
version = V2E
```

naming convention
This specifies the style of the CGGTTS file name. `Plain` specifies a filename in the format `MJD.cctf`. `BIPM` specifies a filename in the format used by the BIPM. This is optional and the default is `Plain`.
Example:

```
naming convention = BIPM
```

reference
This specifies the laboratory reference. This is used in the CGGTTS header and is optional; the default is `UTC(XLAB)`.
Example:

```
reference = UTC(AUS)
```

lab
This specifies the laboratory. This is used in the CGGTTS header and is optional;the default is `XLAB`.
Example:

```
lab = NMIA
```

comments
This is used in the CGGTTS header and is optional;the default is an empty string. *Example:*

```
comments = antenna moved MJD 59601
```

ref dly
This is the reference delay (REF DLY). Its units are nanoseconds. Its use is optional and the default value is zero. *Example:*

```
ref dly = 99.3
```

cab dly
This is the cable delay (CAB DLY). Its units are nanoseconds. Its use is optional and the default value is zero. *Example:*

```
cab dly = 120.2
```

minimum track length
This sets the minimum track length that is acceptable for reporting a satellite track. The units are seconds. This is optional and the default is 390 s.
Example:

```
minimum track length = 750
```

maximum dsg
This sets the maximum value of DSG that is acceptable for reporting a satellite track. The units are nanoseconds. This is optional and the default is 100 ns.
Example:

```
maximum dsg = 10
```

minimum elevation
This sets the minimum satellite elevation (at the middle of the track) that is acceptable for reporting a satellite track. The units for this option are degrees. This is optional and the default is 10 degrees.
Example:

```
minimum elevation = 15
```

maximum ura
This sets the maximum URA for a broadcast ephemeris to be acceptable for use in calculations. Typically, a receiver will report 2 metres, with a few reported at 2.8 metres. IGS ephemerides however will sometimes contain entries with very high URA and these should not be used. The units for this option are metres. This is optional and the default is 3 metres. *Example:*

```
maximum ura = 3.0
```

[GPS delays] section

kind
This specifies the kind of delay for the specified . Valid values are `internal`,`system` and `total`.
Example:

```
kind = internal
```

codes
This defines a comma-separated list of codes for which delays are defined. Use RINEX V3 pseudorange observation codes, as per page 17 of the RINEX V3.04 specification.
Example:

```
codes = C1C,C1W,C2W
```

delays
This sets the value of each delay defined by `codes`, given as a comma-separated list in the same order as in `codes`. The units are ns.
Example:

```
delays = 23.0,22.0,24.0
```

BIPM cal id
This sets the BIPM calibration identifier, written to the CGGTTS header. It overrides the global [CGGTTS] option of the same name. Its use is optional.
Example:

```
BIPM cal id = UNCALIBRATED
```

[Paths] section

rinex observations
The specifies the path to the RINEX observation files.
Example:

```
rinex observations = RINEX
```

rinex navigation
The specifies the path to the RINEX navigation files.
Example:

```
rinex navigation = RINEX
```

CGGTTS output sections

constellation
Valid values are GPS, Galileo, GLONASS and Beidou. Only GPS is supported at present though.
Example:

```
constellation = GPS
```

code
This specifies the code combination to use in the CGGTTS output. For ionosphere-free combinations, both codes are specified, separated by a '+'. Use RINEXV3 pseudorange observation codes, as per page 17 of the RINEX V3.04 specification. These need to be the same as used in the RINEX observation file.
Example:

```
code = C1W + C2W
```

path
This specifies the path that the files will be written to.
Example:

```
path = cggtts\C1
```

report msio
For single frequency outputs, this indicates whether or not to use MSIO.
Example:

```
report msio = yes
```

msio codes
For single frequency outputs where use of MSIO is enabled, this specifies the codes to use for calculating MSIO. Use RINEX V3 pseudorange observation codes, as per page 17 of the RINEX V3.04 specification.
Example:

```
msio codes = C1W + C2W
```

5.10 cnt9xlog.py

Pendulum CNT-90 and CNT-91 counters are supported via USBTMC (in particular, the Python `usbtmc` module).

5.10.1 usage

```
cnt9xlog.py [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-d run in debugging mode
-h print help and exit
-v print version information and exit

5.10.2 configuration file

There is an optional file `cnt9x.cmds` which lists SCPI commands used to configure the counter. This file overrides the default configuration:

```
:SENS:TINT:AUTO OFF
:SENS:FUNC 'TINT 1,2'
:INP1:COUP DC # coupling DC
:INP2:COUP DC
:INP1:IMP 50 # impedance 50 ohms
:INP2:IMP 50
```

```
:INP1:LEVEL 1.0
:INP2:LEVEL 1.0
:INP1:SLOPE POS
:INP2:SLOPE POS
```

5.11 hp5313xlog.pl

HP and Agilent 53131 and 53132 counters are supported, in combination with the IOTech GPIB to RS232 converter.

5.11.1 usage

```
hp5313xlog.pl [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-d run in debugging mode
-h print help and exit
-v print version information and exit

5.11.2 configuration file

There is a file `hp5313x.cmds` which lists the SCPI commands used to configure the counter. For example:

```
:FUNC 'TINT 1,2' # time interval
:SENS:EVEN1:LEVEL:ABS 1.0 # trigger level 1 volt
:SENS:EVEN2:LEVEL:ABS 1.0 #
:SENS:EVEN1:SLOP POS # trigger on positive slope
:SENS:EVEN2:SLOP POS
:INP1:ATT 1 # input attenuation x1
:INP2:ATT 1
:INP1:COUP DC # coupling DC
:INP2:COUP DC
:INP1:IMP 50 # impedance 50 ohms
:INP2:IMP 50
```

It has the following specific configuration file entries in `gpscv.conf`:

- ☐ counter:configuration
- ☐ counter:gpib address
- ☐ counter:gpib converter

5.12 ks53230log.py

Keysight 53230 counters are supported via USB TMC. The script automatically detects the situation where the start trigger occurs after the stop trigger, resulting in incorrect triggering.

5.12.1 usage

```
ks53230log.py [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-d run in debugging mode
-h print help and exit
-v print version information and exit

5.12.2 configuration file

The default is to configure the counter for time-interval measurement of a pair of 1 pps signals, For example:

```
CONF:TINT (@1),(@2)
TRIG:SLOP POS
SYSTEM:TIMEOUT 3
:INP1:PROB 1
:INP2:PROB 1
:INP1:COUP DC
:INP2:COUP DC
:INP1:IMP 50
:INP2:IMP 50
:INP1:SLOP POS
:INP2:SLOP POS
:INP1:LEV 1
:INP2:LEV 1
```

This can be overridden by creating a file with the desired SCPI commands.

It has the following specific configuration file entries in `gpscv.conf`:

- x TBA

5.13 okxemlog.pl

The OpenTTP reference platform includes a multi-channel TIC and this script communicates with the daemon `okcounterd` via a local TCP/IP

socket. The script will exit if no data are returned for more than two minutes.

5.13.1 usage

```
okxemlog.pl [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-d run in debugging mode
-h print help and exit
-v print version information and exit

It has the following specific configuration file entries in `gpscv.conf`:

- ☐ counter::okxem channel.

5.14 prs10log.pl

The Stanford PRS10 rubidium standard has a 1 pps input port that is typically used to lock the PRS10 to a GNSS receiver. The PRS10 timetags each input 1 pps with respect to its own 1 pps and can report these measurements. It can thus be also be used as a time-interval counter. In this application, the lock to the input 1 pps is disabled (ie the PRS10 is left free-running), and the 1 pps measurements are used for time-transfer.

5.14.1 usage

```
prs10log.pl [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-d run in debugging mode
-h print help and exit
-v print version information and exit

The PRS10 is also used as the system time reference so it has entries in `gpscv.conf` associated with this:

- ☐ reference::log status
- ☐ reference::logging interval
- ☐ reference::log path
- ☐ reference::file extension
- ☐ reference::power flag

- reference::status file

5.15 ticclog.py

`ticclog.py` is used to log time interval measurements from a TAPR Timestamping/TIme Interval Counter (TICC). See `https://www.tapr.org/kits_ticc.html` for more information about this counter.

5.15.1 usage

```
ticclog.py [option] ...
```

The command line options are:
--help, -h print help and exit
--config, -c <file> use the specified configuration file
--debug, -d run in debugging mode
--settings, -s print the counter settings
--version, -v print version information and exit

It has the following specific configuration file entries in `gpscv.conf`:

- counter::mode
- counter::timestamp format

When the TICC is in timestamp mode, measurements are split into two files.

5.16 Javad/Topcon receivers

Javad GPS Receiver Interface Language (GRIL) receivers are obsolete and further development of the software described here has ceased. The software has been tested with: Topcon Euro-80 Topcon Euro-160

5.16.1 jnslog.pl

`jnslog.pl` is used to configure and log Javad GRIL receivers.

It doesn't produce a log file.

usage

```
jnslog.pl [option] ... configurationFile
```

The command line options are:
-h print help and exit
-d run in debugging mode

-r suppress the reset of the receiver on startup (NOTE! automatic reset)
-v print version information and exit

configuration

The file `receiver.conf` lists the commands used to configure the receiver. For example, to configure a single frequency receiver:

```
                # GRIL commands
set,out/elm/dev/ser/a,$Init{receiver:elevation mask}
set,pos/iono,off
set,pos/tropo,off
set,dev/pps/a/time,gps
set,dev/pps/a/offs/ns,$Init{receiver:pps offset}
set,dev/pps/a/per/ms,1000
set,dev/pps/a/out,on

# Receiver messages to turn on
RT # Receiver time
TO # Receiver base time to receiver time offset
ZA # PPS offset (sawtooth)
YA # Extra time offset
SI # Satellite index
EL # Satellite elevation
AZ # Satellite azimuth
SS # Satellite navigation status
FC # C/A lock loop status bits
F1
F2
RC # Full pseudorange C/A
R1 # Full pseudorange P/L1
R2 # Full pseudorange P/L2
P1 # For RINEX Obs
P2 # For RINEX Obs
RD # For RINEX
NP # Navigation Position text message
UO:{3600,14400,0,2} # UTC parameters, when changes or
    ↪ every 4 hrs
IO:{3600,14400,0,2} # Ionospheric parameters
GE:{1,3600,0,2} # GPS ephemeris data
```

The GRIL commands in the first part of the file are executed verbatim, with subsitution of values from the configuration file, written as Perl hash table lookups. Messages to be enabled are then listed, one per line. The message rate can be specified in the GRIL syntax.

Configuration commands in `gpscv.conf` specific to this receiver are:

JNS receivers have a number of specific configuration entries in `gpscv.conf`:

- receiver::configuration
- receiver::pps synchronization
- receiver::pps synchronization delay
- paths::rinex l1l2

5.16.2 jnsextract.pl

`jnsextract.pl` is used to decode and extract information from Javda receiver log files. It will decompress the file if necessary. It doesn't use `gpscv.conf`.

usage

```
jnsextract.pl [option] ... file
```

The command line options are:
-b <value> start time (s or hh:mm, default 0)
-c compress (eg skip repeat values) if possible
-e <value> stop time (s or hh:mm, default 24:00)
-g select GPS only
-i <n> decimation interval (in seconds, default=1)
-k keep the uncompressed file, if created
-o <mode> output mode:
bp receiver sync to reference time (BP message)
cn carrier-to-noise vs elevation
do DO derivative of time offset vs time
si visibility vs time (SI message)
np visibility vs time (NP message)
vt visibility vs time (list time for each SV)
tv visibility vs time (list SV for each time)
tr satellite tracks (PRN, azimuth, elevation)
tn satellite tracks (PRN, azimuth, elevation, CN)
to TO time offset vs time
ya YA time offset vs time
za ZA time offset vs time
st ST solution time tag vs time
uo UO UTC parameters
-r select GLONASS only

5.16.3 runrinexobstc.pl

`runrinexobstc.pl` runs the now deprecated `rinexobstc`, which produces a RINEX observation file suitable for precise positioning when used with a suitable Javad receiver. `mktimetx` can now be configured to produce suitable output.

`runrinexobstc.pl` doesn't produce a log file.

usage

`runrinexobstc.pl` is normally run as a `cron` job.

To run `runrinexobstc.pl` on the command line, use

```
runrinexobstc.pl [option] ... [Start MJD [Stop MJD]]
```

`Start MJD` and `Stop MJD` specify the range of MJDs to process. If a single MJD is specified, then data for that day is processed. If no MJD is specified, the previous day's data is processed.

The options are:

-a <file> extend check for missed processing back `n` days (the default is 7)
-c <file> use the specified configuration file
-d run in debugging mode
-h print help and exit
-x run missed processing
-v print version information and exit

configuration

`runrinexobstc.pl` uses `gpscv.conf`.

It uses the following specific configuration file entries in `gpscv.conf`; most relate to writing the RINEX observation file header:

- ☐ antenna::x
- ☐ antenna::y
- ☐ antenna::z
- ☐ antenna::marker name
- ☐ antenna::marker number
- ☐ antenna::delta e
- ☐ antenna::delta h

- ☐ antenna::delta n
- ☐ antenna::antenna number
- ☐ antenna::antenna type
- ☐ rinex::agency
- ☐ rinex::observer
- ☐ paths::rinex l1l2

5.17 NVS NV08C receivers

This receiver has become difficult to buy in small quantities and development of the software described here has ceased.

5.17.1 nv08log.pl

`nv08log.pl` is used to configure and log NVS NV08 receivers. It needs the Perl library `NV08C`.

It doesn't produce a log file.

There are no NV08-specific configuration commands in `gpscv.conf`.

usage

```
nv08log.pl [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-h print help and exit
-d run in debugging mode
-r reset the receiver on startup
-v print version information and exit

5.17.2 nv08extract.pl

`nv08extract.pl` is used to decode and extract information from NVS NV08 receiver log files. It will decompress the file if necessary.

It uses `gpscv.conf` to construct receiver log file names if the file is not explicitly given.

usage

```
nv08extract.pl [option] ... [file]
```

Given an MJD via a command line option, it will construct a file name using the information in `gpscv.conf`. If no MJD or file is given, it assumes the current MJD for the file.

The command line options are:
-c <file> use the specified configuration file
-h print help and exit
-d run in debugging mode
-v print version information and exit
-m <MJD> MJD of the file to process
-t extract Time, Date and Time Zone offset
-o extract Receiver Operating Parameters
-s extract Visible Satellites
-n extract Number of Satellites and Dilution Of Precision (DOP)
-w extract Software Version, Device ID and Number of Channels
-f extract 1 PPS 'sawtooth' correction
-T extract Time Synchronisation Operating Mode (antenna cable delay, averaging time)
-p extract PVT Vectors and associated quality factors (including TDOP)
-a extract Additional Operating Parameters
-P extract Port status messages
-e extract Satellite ephemeris
-l extract Time scale parameters
-i extract Ionosphere parameters
-g extract GPS, GLONASS and UTC time scale parameters
-r extract Raw data (pseudoranges, etc)
-G extract Geocentric antenna coordinates in WGS-84 system
-u extract Unknown message (garbage data)
-z less verbose output

5.17.3 nv08info.pl

This actually does nothing useful. If it did, it would query the receiver for its serial number and so on.

usage

```
nv08info.pl [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-h print help and exit
-d run in debugging mode
-v print version information and exit

5.18 Septentrio receivers

A typical processing chain for the Septentrio receiver looks like:

1. `plrxlog.py` to log the receiver
2. `runsbf2rnx.py` to generate RINEX files from SBF
3. `mkcggtts.py` to generate CGGTTS files from RINEX

Currently, the processing chain relies on the tools provided by Septentrio and r2cggtts. Open source replacements for these are currently under development. OpenTTP now provides `sbf2rnx` as a replacement for sbf2rin, but this is limited to GPS at present.

5.18.1 plrxlog.py

`plrxlog.py` is used to configure and log Septentrio receivers. Unlike the other receiver logging scripts, it logs using the receiver's native binary data format, rather than the custom OpenTTP format. It has mainly been used with mosaicT receivers.

It doesn't produce a log file.

usage

```
plrxlog.py [option] ... configurationFile
```

The command line options are:
–**config <file>, -c <file>** use the specified configuration file
–**debug, -d** run in debugging mode
–**reset, -r** reset receiver and exit
–**help, -h** print help and exit
–**version, -v** print version information and exit

A reset command issues:

```
exeResetReceiver,Hard,PVTData+SatData
```

configuration

The file `receiver.conf` lists any custom commands used to configure the receiver. These are written in Septentrio XXX format, and passed verbatim to the receiver. For example,

```
lstInternalFile,Identification
SetPPSparameters,sec1,Low2High,0,RxClock,60
SetTimeSyncSource,EventA
SetSignalTracking,+GPSL1PY+BDSB2A+GALE5
```

The default configuration for the mosaicT enables SBF output and the message set needed for RINEX generation and the SatVisibility message.

5.18.2 mosaicmkdev.py

`mosaicmkdev.py` is used to create a symbolic link for the mosaic-T receiver. Currently, it identifies a receiver by the serial number of the USB hub that the various available USB devices in the mosaic-T (development kit) are accessed through. It is typically used with a `udev` rule, an example of which is included in the OpenTTP distribution.

The default configuration file is `/usr/local/etc/mosaicmkdev.conf` which looks like:

```
[main]
receivers = mos01

[mos01]
serial number = 3612929

# Symlinks to be made
ttyACM0 = mos01ACM0
ttyACM1 = mos01ACM1
```

The `receivers` option is a comma-separated list of section names, as per the usual convention. Each section defines the setup for a particular receiver.

The serial number is currently matched through the `udev` 'root device' property 'ID_SERIAL_SHORT'.

The symlinks to be made in `/dev` are defined by the Linux device names (`ttyACM0`, `ttyACM1` only at present).

Startup errors reported via `udev` can be examined using

```
systemctl status systemd-udevd
```

5.18.3 runsbf2rnx.py

`runsbf2rnx.py` is a wrapper for `sbf2rin`, provided by Septentrio. It provides batch processing and fixes for some problems with the RINEX files.

usage

```
runsbf2rnx.py [OPTION] ... [mjd [mjd ...]]
```

The command line options are:

--help,-h print the help information and exit

--config <file>, -c <file> use the specified configuration file
--debug,-d print debugging information to stderr
--version,-v show the version information and exit

configuration

[Main] section

exec
This specifies the path to the executable `sbf2rin`. The default is `/usr/local/bin/sbf2rin`.

sbf station name

[Receiver] section

file extension

[RINEX] section

version
This option specifies the RINEX version for the output, via the '-R' option to `sbf2rin`. The version is specified using the same syntax as `sbf2rin` uses.
Example:

```
version = 3
```

name format

obs directory
This option specifies where generated RINEX observation files are saved.

nav directory
This option specifies where generated RINEX navigation files are saved.

obs sta
This option specifies the station name to use for RINEX observation files.
Example:

```
# a V2 style name
obs sta = SYDN
# a V3 style name
obs sta = SYDN00AUS
```

nav sta
This option specifies the station name to use for RINEX navigation files.
Example:

```
# a V2 style name
nav sta = SEP1
```

create nav file
This option controls generation of a RINEX navigation files by `sbf2rin` via its '-n' option.

exclusions
This option specifies GNSS to be excluded from the generated RINEX files via the '-x' option to `sbf2rin`. The GNSS are specified using the same syntax as `sbf2rin` uses.
Example:

```
exclusions = ISJ
```

fix header
This option specifies whether or not the RINEX header should be edited. The RINEX header generated by sbf2rin needs a few fixes to be useable by other software like Bernese.

header fixes
This option specifies the file to use when fixing the RINEX header. The file specifies replacements for lines in the RINEX header, and needs to be in RINEX format.

fix satellite count
Some older versions of `sbf2rin` incorrectly report the number of satellites in the RINEX observation file header when GNSS are excluded via the '-x' option to `sbf2rin`. The offending line in the RINEX header is removed, since it is optional.
Example:

```
fix satellite count = yes
```

[Paths] section

receiver data

tmp
This option specifies where to write temporary files to. Temporary files are removed after use.

5.18.4 sbf2rinbatch.py

`sbf2rinbatch.py` is used for batch processing of SBF files via Septentrio's tool `sbf2rin`.

5.18.5 mksephourly.py

`mksephourly.conf` is used for hourly generation of REFSYS from CGGTTS files. It is intended for 'live' monitoring of time-transfer. The script calls `runsbf2rnx.py` to generate RINEX, and then `mkcggtts.py` to generate CGGTTS. A new file named MJD.dat is created each day, and updated by rewriting it each time `mksephourly.py` is called.

The format of this file is:

```
MJD TOD (in seconds) REFSYS (mean) number of tracks
```

The command line options are:
–**config <file>, -c <file>** use the specified configuration file
–**debug, -d** run in debugging mode
–**help, -h** print help and exit
–**version, -v** print version information and exit

The default configuration file is `/etc/mksephourly.conf` which looks like:

```
[Main]
runsbf2rnx conf = etc/hourly.runsbf2rnx.conf
cggtts source = CGGTTS-GPS-P3
mkcggtts conf = etc/hourly.mkcggtts.conf
summary path = hourly_tt/summary
```

runsbf2rnx conf
This defines the configuration file to be used by `runsbf2rnx.py`.

mkcggtts conf
This defines the configuration file to be used by `mkcggtts.py`.

cggtts source
This defines the section in the configuration file used by `mkcggtts` for CGGTTS file generation. It is used to locate and identify the CGGTTS files that REFSYS is extracted from.

summary path
This defines where summary files are written to.

5.18.6 sbf2rnx

Experimental!

5.19 Trimble Resolution T receivers

Trimble Resolution T receivers are obsolete and further development of the software described here has ceased. The successor to the Resolution T, the SMT 360, cannot currently be used for time-transfer because of changes in the message set. It is possible though that a future TSIP-based receiver may be suitable for time-transfer.

5.19.1 restlog.pl

usage

```
restlog.pl [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-h print help and exit
-d run in debugging mode
-r reset the receiver on startup
-v print version information and exit

configuration

`restlog.pl` respects the `receiver::model` configuration option. The valid values are:

1. Resolution T
2. Resolution SMT 360

5.19.2 restextract.pl

`restextract.pl` is used to decode and extract information from Trimble receiver log files. It will decompress the file if necessary.

usage

```
restextract.pl [option] ...
```

Given an MJD via a command line option, it will construct a file name using the information in `gpscv.conf`. If no MJD is given, it assumes the current MJD for the file.

The command line options are:
-c <file> use the specified configuration file
-h print help and exit
-v print version information and exit

-a extract S/N for visible satellites
-f show firmware version
-l leap second warning
-L leap second info)
-m <mjd> MJD of the file to process
-p position fix message
-r <svn> pseudoranges for satellite with given SVN (svn=999 reports all satellites)
-s number of visible satellites
-t temperature
-u UTC offset
-x alarms and gps decoding status

5.19.3 restinfo.pl

`restinfo.pl` communicates with the receiver configured in `gpscv.conf`, polling it for information such as hardware, software and firmware versions. The serial port communication speed must be 115200 baud.

usage

```
restinfo.pl [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-h print help and exit
-d run in debugging mode
-v print version information and exit

5.19.4 restconfig.pl

`restconfig.pl` is used to configure the receiver serial port for 115200 baud and no parity bit. The latter is necessary for using the SMT 360 with `ntpd`. The new configuration is written to flash memory.

usage

```
restconfig.pl [option] ...
```

The command line options are:
-c <file> use the specified configuration file
-h print help and exit
-d run in debugging mode
-v print version information and exit

The serial port device name is read from `gpscv.conf` or the specified file.

5.19.5 restplayer.pl

This is used to replay raw data files through a serial port, simulating the operation of the GNSS receiver. This is useful for testing the operation of `ntpd`, for example. This script will have to be modified for individual use because it currently hard codes paths and device names.

5.20 ublox receivers

5.20.1 ublox9log.py

This `python3` script is used with ublox series 9 receivers like the ZED-F9P and ZED-F9T. The following messages are enabled for 1 Hz output:

- ☐ RXM-RAWX
- ☐ TIM-TP
- ☐ NAV-SAT (not logged)
- ☐ NAV-TIMEUTC
- ☐ NAV-CLOCK

A status file is written once per minute, containing the SV identifiers of tracked satellites with code and time synchronization flags set.

usage

```
ublox9log.py [option] ...
```

The command line options are:
--help, -h print help and exit
--config, -c <file> use the specified configuration file
--debug, -d run in debugging mode
--reset, -r reset the receiver before configuration
--version, -v print version information and exit

configuration

`ublox9log.pl` respects the `receiver::model` configuration option. The valid values are:

1. ZED-F9

5.20.2 ubloxlog.pl

This script used to configure and log series 8 receivers like the NEO-M8T.

usage

```
ubloxlog.pl [option] ...
```

The command line options are:
-h print help and exit
-c <file> use the specified configuration file
-d run in debugging mode
-r reset the receiver before configuration
-v print version information and exit

5.20.3 ubloxextract.py

`ubloxextract.py` is used to decode and extract information from ublox receiver log files written in OpenTTP format. It will decompress the file if necessary.

It uses `gpscv.conf` to construct receiver log file names if the file is not explicitly given.

usage

```
ubloxextract.py [option] ... [file]
```

Given an MJD via a command line option, it will construct a file name using the information in `gpscv.conf`. If no MJD or file is given, it assumes the current MJD for the file.

The command line options are:
--help, -h print help and exit
--config, -c <file> use the specified configuration file
--debug, -d run in debugging mode
--version, -v print version information and exit
--mjd, -m <MJD> MJD of the file to process
--uniqid show chip id
--monver show hardware and software versions
--navclock extract nav-clock message
--navsat extract nav-sat message
--navtimeutc extract nav-timeutc message
--rawx extract raw measurement data
--timtp extract sawtooth correction

5.20.4 ubloxmkdev.py

`ubloxmkdev.py` is used for creating a device name for a connected receiver. It is useful, for example, when multiple receivers are connected and unique

USB device identification is not possible. It works by connecting to the receiver and querying its serial number. A configuration file defines the device name for that serial number.

The script is typically called by udev.

usage

```
ubloxmkdev.py [option] ... dev
```

The command line options are:
--help, -h print help and exit
--debug, -d run in debugging mode
--version, -v print version information and exit

configuration

The configuration file is `/usr/local/etc/ublox.conf`. It looks like:

```
ce92fa1422 ublox1
77435b1763 ublox2
```

Each line consists of the receiver's serial number and the device name to be associated with it.

5.21 Miscellaneous tools

5.21.1 cggttsqc.py

`cggttsqc.py` performs various checks on CGGTTS files. Running it on a single CGGTTS file with no options will produce output like:

File	Tracks	Short	Min SV	Max SV	High DSG	Low ELV
57401.cctf	706	71	3	11	0	0

where:
'Tracks' is the total number of tracks
'Short' is the number of tracks with length less than a specified threshold (default 780 s)
'Min SV' is the minimum number of SVs visible
'Max SV' is the maximum number of SVs visible
'High DSG' is the number of tracks with DSG above a specified threshold (default 20 ns)
'Low ELV' is the number of tracks with elevation below a specified threshold (default 10 degrees)

usage

```
cggttsqc.py [OPTION] ... file [file ldots]
```

The command line options are:

--help,-h print the help information and exit

--debug,-d print debugging information to stderr

--nowarn suppress warnings (eg about missing files, bad formatting in CGGTTS files)

--dsg <value> set the upper limit for acceptable DSG. The units are ns.

--elevation <value> set the lower limit for acceptable elevation. The units are degrees.

--tracklength <value> set the lower limit for acceptable track length. The units are seconds.

--checkheader show when significant fields in the header change, for example the delays.

--nosequence do not interpret (two) input filenames as a sequence.

--plotcount plot a histogram of satellite count at each scheduled track time

--version,-v show the version information and exit

examples

Mutiple files can be checked and a sequence can be specified with two file names. For example:

```
cggttsqc.py --dsg 5 GZAA0157.834 GZAA0157.876
```

will report on all files between MJDs 57834 and 57876, indicating in the DSG field the number of tracks with DSG greater than 5 ns. For the two file names to be interpreted as a sequence, they must:

1. have names in v2E CGGTTS recommended format or in the format MJD.xxx
2. be in the same directory
3. have the same extension, if in the format MJD.xxx

5.21.2 cmpcggtts.py

`cmpcggtts.py` matches tracks in paired CGGTTS files. It can be used for time transfer and delay calibration. It reads V1, V2, V2E CGGTTS files. It also reads the raw 30 s files produced by r2cggtts.

usage

To run `kickstart.py` on the command line, use:

```
cmpcggtts.py [option] ... refDir calDir firstMJD lastMJD
```

where

refDir directory for reference receiver
calDir directory for receiver being calibrated
firstMJD first MJD to be processed
lastMJD last MJD to be processed

The command line options are:
--help show this help message and exit
--starttime <time> time of day in HH:MM:SS format to start processing (default 00:00:00)
--stoptime <time> time of day in HH:MM:SS format to stop processing (default 23:59:00)
-–calfrc <calfrc> set the calibration FRC code (L1C,L3P,...)
-–reffrc <refrc> set the reference FRC code (L1C,L3P,...)
--elevationmask <value> elevation mask (in degrees, default 0.0)
--mintracklength <value> minimum track length (in s, default 750)
--maxdsg <value> maximum DSG (in ns, default 20.0)
--matchephemeris match on ephemeris (default no)
--cv compare in common view (default)
--aiv compare in all-in-view
--acceptdelays accept the delays (no prompts in delay calibration mode)
--refintdelays <REFINTDELAYS> search for given internal delays in reference eg "GPS P1,GPS P2"
--calintdelays <CALINTDELAYS> search for given internal delays in cal eg "GPS C2"
--delaycal delay calibration mode
--timetransfer time-transfer mode (default)
--ionosphere use the ionosphere in delay calibration mode (default = not used)
--useRefMSIO use the measured ionosphere (mdio is removed from refsys and msio is subtracted, useful for V1 CGGTTS)
--useCalMSIO use the measured ionosphere (mdio is removed from refsys and msio is subtracted, useful for V1 CGGTTS)
--checksum exit on bad checksum (default = warn only)
--refprefix <value> file prefix for reference receiver (default = MJD)
--calprefix <value> file prefix for calibration receiver (default = MJD)
--refext <value> file extension for reference receiver (default = cctf)
--calext <value> file extension for calibration receiver (default = cctf)

--comment <COMMENT> set comment on displayed plot
--debug, -d debug (to stderr)
--nowarn suppress warnings
--quiet suppress all output to the terminal
--keepall keep tracks after the end of the day
--version, -v show version and exit

The default mode is time-transfer. In this mode, a linear fit to the time-transfer data is made and the fractional frequency error and REFSYS (evaluated at the midpoint of the data set) are outputted. The uncertainties are estimated from the linear fit.

In delay calibration mode, the presumption is that the data are for two receivers sharing a common clock and operating on a short baseline. The ionosphere correction is removed by default but can be retained via a command line option. Delays as reported in the CGGTTS header can be changed interactively; prompting for the new delays can be skipped with a command line option.

Data can be filtered by elevation, track length and DSG.

Matching on ephemeris (IODE) can also be enforced. This can reduce time-transfer noise when CGGTTS files produced by different programs are compared.

Three text files are produced.

examples

Basic common-view time transfer with CGGTTS files in the folders `refrx` and `remrx`:

```
cmpcggtts.py refrx remrx 57555 57556
```

Delay calibration with filenames according to the CGGTTS V2E specification:

```
cmpcggtts.py --delaycal --refprefix GZAU01 --calprefix
    ↪ GZAU99 refrx remrx 57555 57556
```

5.21.3 editcggtts.py

`editcggtts.py` is used to edit CGGTTS navigation files. The header checksum and the modification time are updated after editing,

usage

```
editcggtts.py [option] ... filename [filename ...]
```

The command line options are:
--help,-h print the help information and exit
--debug,-d print debugging information to stderr
--comments <value> set comment
--output,-o <value> output to file/directory
--tmp output is to file(s) with .tmp added to name
--replace, -r replace the edited file(s)
--nosequence do not interpret (two) input file names as a sequence
--nowarn suppress warnings
–version,-v show the version information and exit

The `--output`, `--tmp` and `--replace` options are mutually exclusive. If none of these options are used, output will be to `stdout`.

If two filenames are given without the `--nosequence` option, they will be interpreted as specifying a sequence of files to be processed.

5.21.4 editrnxnav.py

`editrnxnav.py` is used to edit RINEX navigation files. Currently, it doesn‘t do much but it will eventually do much more.

usage

```
cggttsqc.py [option] ... file
```

The command line options are:
--help,-h print the help information and exit
--debug,-d print debugging information to stderr
--output <value> output to file/directory
--replace, -r replace edited file
--ura, -u <value> remove entries with URA greater than this
–version,-v show the version information and exit

5.21.5 editrnxobs.py

`editrnxobs.py` is used to edit RINEX observation files.

usage

```
editrnxobs.py [option] ... file [file ...]
```

The command line options are:
--help, -h print the help information and exit
--debug, -d print debugging information to stderr
--output,-o <file> output to file/directory

--keep, -k keep intermediate files
--replace, -r replace edited file
--system <system> gnss system (BeiDou,Galileo,GPS,GLONASS)
--obstype <obstype> observation type (C2I,L2I,...)
--fixms fix ms ambiguities (ref RINEX file required)
--fixmissing add observations missing at the beginning of the day
--sequence, -s interpret input files as a sequence
--refrinex <file> reference RINEX file for fixing ms ambiguities (name of first file if multiple input files are specified)
--version, -v show the version information and exit

5.21.6 fetchigs.py

`fetchigs.py` uses the Python library `urllib` to download GNSS products and station observation files from IGS data centres. You will need a configuration file that sets up downloads from at least one IGS data centre. The sample configuration file should be sufficient for most uses.

usage

```
fetchigs.py [option] ... start [stop]
```

The `start` and `stop` times can be in the format:
MJD Modified Julian Date
yyyy-doy year and day of year (1 . . .)
yyyy-mm-dd year, month (1-12) and day (1 . . .)

The command line options are:
--help, -h print help and exit
--config <file> , -c use this configuration file
--debug, -d print debugging output to stderr
--outputdir <dir> set the output directory
--ephemeris get broadcast ephemeris
--clocks get clock products (.clk)
--orbits get orbit products (.sp3)
--rapid fetch rapid products
--final fetch final products
--centre <centre> set data centres
--listcentres, -l list available data centres
--observations get station observations (only mixed observations for V3)
--statid <statid> station identifier (eg V3 SYDN00AUS, V2 sydn)
--rinexversion <2,3> rinex version of station observation files
--system <system> gnss system (GLONASS,BEIDOU,GPS,GALILEO,MIXED
--noproxy disable use of proxy server
--proxy <proxy> set your proxy server (server:port)

--version, -v print version information and exit

examples

This downloads V3 mixed observation files from the IGS station CEDU, with the identifier CEDU00AUS for days 10 to 12 in 2020.

```
fetchigs.py --centre CDDIS --observations --statid
    ↪ CEDU00AUS --version 3 --system MIXED 2010-10
    ↪ 2020-12
```

This downloads final IGS clock and orbit products for MJD 58606 from the CDDIS data centre.

```
fetchigs.py --centre CDDIS --clocks --orbits --final 58606
```

This downloads a `brdc` broadcast ephemeris file.

```
fetchigs.py --centre GSSC --ephemeris --system MIXED --
    ↪ rinexversion 2 58606
```

configuration file

The `[Main]` section has two keys.

Data centres
This is a comma-separated list of sections which define IGS data centres which can be used to download data.
Example:

```
Data centres = CDDIS,GSSC
```

Proxy server
This sets a proxy server (and port) to be used for downloads.
Example:

```
Proxy server = someproxy.in.megacorp.com:8080
```

Each defined IGS data centre has the following keys, defining various paths.

Base URL
This sets the base URL for downloading files.
Example:

```
Base URL = ftp://cddis.gsfc.nasa.gov
```

Broadcast ephemeris
This sets the path relative to the base URL for downloading broadcast ephemeris files.
Example:

```
Broadcast ephemeris = gnss/data/daily
```

Products
This sets the path relative to the base URL for downloading IGS products.
Example:

```
Products = gnss/products
```

Station data
This sets the path relative to the base URL for downloading IGS station RINEX files.
Example:

```
Station Data = gnss/data/daily
```

5.21.7 ticqc.py

`ticqc` checks TIC files. It currently reports the total number of measurements, duplicates and gaps in the file, and the data range.

usage

```
ticqc.py [option] file
```

The command line options are:
--help, -h print help and exit
--verbose verbose output eg duplicate measurements are printed out
--version, -v print version information and exit

6. System software

6.1 dioctrl

`dioctrl` is used to provide access to a digital I/O port. On Intel platforms, the currently supported hardware includes the 8255 parallel port and the SIOF8186x. `dioctrl` is not currently functional on the ARM platform.

6.2 kickstart.py

`kickstart.py` is used to check that required processes are running, and restart them if necessary. It is used to start the receiver and counter logging processes, for example.

The lock file for each process (target) contains the running process ID; this is used by `kickstart.py` to test whether the target is running.

`kickstart.py` produces a log file in the user's home directory, `logs/kickstart.log`. Each time a process is checked, it touches the file `logs/kickstart.target.check`, where `target` is specified in the configuration file.

6.2.1 usage

To run `kickstart.py` on the command line, use:

```
kickstart.py [option] ...
```

The command line options are:
–**config FILE, -c FILE** use the specified configuration file
–**debug, -d** run in debugging mode
–**help, -h** print help and exit
–**version, -v** print version information and exit

6.2.2 configuration file

An example configuration file is:

```
targets = okxem
[okxem]
target = okxem
command = bin/okxemlog.pl
lock file = logs/okxem.gpscv.lock
```

targets
This defines a list of sections, each of which corresponds to a process to monitor.
Example:

```
targets = restlog,okxem
```

target
This defines a target identifier. It is used to construct filenames and as an identifier in logged messages.
Example:

```
target = okxem
```

command
This defines the command used to start the target. Options can be used.
Example:

```
command = bin/okxemlog.pl
```

lock file
This defines the lock file associated with a target.
Example:

```
lock file = logs/okxem.gpscv.lock
```

Paths specified in the configuration file are constructed using the usual rules.

6.3 mjd

`mjd` provides conversion between a calendar date and MJD and shows the current MJD.

6.3.1 usage

```
mjd [option]
```

The command line options are:
-d <DD MM YYYY> convert date to MJD
-h print help and exit

-m <MJD> convert MJD to date
-t print today's MJD and exit
-v print version information and exit

6.4 okcounterd

`okcounterd` provides the interface to the Opal Kelly FPGA development board when configured as a multi-channel counter. It communicates with user processes via port 21577 (it's the date "Star Wars" premiered). Mutiple processes can communicate with the daemon so that logging processes can be separated.

`okcounterd` does not use a configuration file and does not produce a log file.

`okcounterd` recognizes the following commands, sent as plain text:
CONFIGURE GPIO 0|1 enables/disables the system GPIO.
CONFIGURE PPSSOURCE n selects the input channel of the counter which is routed to the output 1 pps.
QUERY CONFIGURATION reads the device configuration register. `okcounterd` sends a plain text response.
LISTEN registers a process to receive counter-timer readings.

`okcounterdctrl.pl` provides a convenient way to send commands.

Counter/timer data sent by `okcounterd` is in the following format:

```
channel_number timestamp (s) timestamp (μs) reading (ns)
```

Channel numbers are indexed from 1.

6.4.1 usage

`okcounterd` is automatically started by the system's init system. On Debian, this is `systemd`. It can be run manually for debugging purposes. Use:

```
okcounterd [OPTION] ...
```

The command line options are:
-b <file>load the specified bitfile (the full path is needed)
-d run in debugging mode
-h print help and exit
-v print version information and exit

To manually run `okcounterd`, you may need to disable the system service and kill any running `okcounterd` process.

6.5 okcounterdctl.pl

`okcounterdctl.pl` provides a convenient way to send commands to `okcounterd`.

`okcounterdctl.pl` doesn't have a configuration file. It uses `gpscv.conf` to determine the port used by `okcounterd`.

`okcounterdctl.pl` doesn't produce a log file.

6.5.1 usage

To run `okcounterdctl.pl` on the command line, use:

```
okcounterdctl.pl [OPTION] ...
```

The command line options are:
-d run in debugging mode
-g <0|1> disable/enable the system GPIO
-h print help and exit
-o <1...6> set the PPS OUT source
-p PORT set the port to connect to `okcounterd` (default is 21577)
-q query the counter configuration
-v print version information and exit

channel	PPS signal
1	NavSpark
2	SMT360
3	NV08C
4	external pps
5	system time pps
6	GPIO
default	GPSDO

Table 6.1: PPS OUT channels for the `-p` option

The default state is to output the GPSDO 1 pps.

6.6 okbfloader

`okbfloader` is used to load a bitfile to the XEM6001. Normally, `okcounterd` will load the bitfile it needs on startup. `okbfloader` is mainly used during development and testing.

6.6.1 usage

```
okbfloader [option] ... file
```

The command line options are:
-h print help and exit
-v print version information and exit

6.7 lcdmonitor

`lcdmonitor` runs the lcd display on the front panel of the unit.

`lcdmonitor` produces a log file `/usr/local/log/lcdmonitor.log` that records significant commands run from the front panel, for example reboots.

A lock file `/usr/local/log/lcdmonitor.lock` is used to prevent duplicate processes from running.

6.7.1 usage

`lcdmonitor` is automatically started by the system's init system. On Debian, this is `systemd`. It can be run manually for debugging purposes.

The command line options are:
-d run in debugging mode
-h print help and exit
-v print version information and exit

To run `ldcmonitor` on the command line, you will need to disable the entry in `/etc/inittab`, reread the `inittab` and kill any running `lcdmonitor` process.

6.7.2 configuration file

The configuration file for `ldcmonitor` is `/usr/local/etc/lcdmonitor.conf`. This file is only modifiable by the super-user. The file is divided into sections, with section names delimited by square brackets [ ].
Example:

```
token = value
```

Comments begin with a `#` character. Entries in the various sections of the configuration file are given below.

[General] section

NTP user
This defines the name of the user associated with NTP functions.
Example:

```
NTP user = ntp-admin
```

Squealer config
This specifies the location of the configuration file used by `squealer`, a program used to detect system problems.
Example:

```
Squealer config = /home/cvgps/etc/squealer.conf
```

[UI] section

Show PRNs
This specifies whether or not to show the PRNs (or Space Vehicle identifiers) of GPS satellites being tracked by the receiver. If this is set to zero, then only the number of satellites tracked is displayed.
Example:

```
Show PRNs=1
```

LCD intensity
This sets the intensity of the LCD display. Valid values are 0 to 100.
Example:

```
LCD intensity=90
```

LCD contrast
This sets the contrast of the LCD display. Valid values are 0 to 100.
Example:

```
LCD contrast=95
```

[GPSCV] section

GPSCV user
This defines the name of the user associated with GPSCV functions.
Example:

```
GPSCV user = cvgps
```

gpscv config
This defines the location of the file `gpscv.conf`.
Example:

```
GPSCV config = /home/cvgps/etc/gpscv.conf
```

GPS restart command
This specifies the command used to restart the GPS receiver. Note that since `lcdmonitor` runs as `root`, the restart must be explicitly done as `cvgps`.
Example:

```
GPS restart command =su - cvgps -c '/home/cvgps/bin/
    ↪ check_rx'
```

GPS logger lock file
This specifies location of the lock file used by the GPS logging process. It is used to determine which process needs to be killed before a restart.
Example:

```
GPS logger lock file=/home/cvgps/logs/rx.lock
```

[OS] section

Reboot command
This specifies the command used to reboot the PC.
Example:

```
Reboot command = /sbin/shutdown -r now
```

Poweroff command
This specifies the command used to shut down the PC.
Example:

```
Poweroff command = /sbin/shutdown -t 3 -h
```

ntpd restart command
This specifies the command used to restart `ntpd`.
Example:

```
ntpd restart command = /sbin/service ntpd restart
```

[Network] section

DNS
Example:

```
DNS = /etc/resolv.conf
```

Network
Example:

```
Network = /etc/sysconfig/network
```

Eth0
Example:

```
Eth0 = /etc/sysconfig/network-scripts/ifcfg-eth0
```

6.8 libraries

6.8.1 libconfigurator

This is a C library used for parsing of configuration files. It is mainly used by `mktimetx`.

The configuration file is read using

```
int configfile_parse_as_list(ListEntry **first,const char
    ↪ *filename)
```

This returns a pointer to the first item in a linked list of `ListEntry`, which describe entries in the configuration file.

Functions are provided for searching the list for an entry by section and key (token) name, returning a value of the required type.

```
int list_get_int(ListEntry *first,const char *section,
    ↪ const char * token,int *value);
int list_get_float(ListEntry *first,const char *section,
    ↪ const char * token,float *value);
int list_get_double(ListEntry *first,const char *section,
    ↪ const char * token,double *value);
int list_get_string(ListEntry *first,const char *section,
    ↪ const char * token,char **value);
```

The return value of the function flags whether or not an error occurred. The last error to occur is determined by calling:

```
config_file_get_last_error()
```

The error codes are:

```
NoError
FileNotFound
SectionNotFound
InternalError
ParseFailed
TokenNotFound
```

`list_clear()` can be used to delete the list.

This should be replaced one day by something based on the C++ STL!

6.8.2 TFLibrary.pm

This library is effectively deprecated because all new development is now in Python.

6.8.3 OpenOK2

This is a C++ library that can be used for communicating with the Opal Kelly FPGA board. It is a fork of a library originally written by Jennifer Holt and now manintained by Jorge Francisco. Opal Kelly provides a similar library for a number of platforms. When OpenTTP development began, ARM support was not available hence the use of OpenOK2. One significant limitation of the library is that it does not provide support for USB block transfers.

6.8.4 ottplib.py

This library replaces `TFLibrary.pm` and should be used for all new development.

ottplib.**LoadConfig**(*path, options*={})

Loads the configuration file specified by `path`, returning key/value pairs as a dictionary. Two options can be supplied:
tolower all keys are converted to lower case if this is `true`
defaults a default configuration file is loaded first

Example:

```
cfg=ottplib.LoadConfig(configFile,{'tolower':True})
```

ottplib.**MJD**(*time*)

Returns the Modified Julian Date, given the time in seconds since the epoch. It is usually called with `time.time()`

ottplib.**MakeAbsolutePath**(*path,root*)
Returns a path constructed relative to `root`, unless `path` is already absolute. A trailing slash is added if it is absent.

ottplib.**MakeAbsoluteFilePath**(*file,home,defaultPath*)

Returns an absolute path to `file` according to the following rules

1. If `path` begins with a slash then it is returned unchanged.
2. If `path` ends with a slash, then `home` is prepended.
3. Otherwise, `defaultPath` is prepended.

ottplib.**CreateProcessLock**(*file*)

Creates a lock file named `file`. The contents of the file are the process name and its PID. When attempting to create a lock, the PID is checked in `proc`. Returns `True` if the lock was successfully created.

ottplib.**RemoveProcessLock**(*file*)
Removes the lock file named `file`. It returns nothing.

6.8.5 cggttslib.py

This library provides some functions for reading and manipulating CGGTTS files.

cggttslib.**CheckSum**(*string*)

This computes the checksum of `string` using the algorithm described in the CGGTTS specification. The checksum is returned as an integer.

cggttslib.**ReadHeader**(*file*)

This reads the CGGTTS header of `file` and returns the fields in a Python dictionary. Dictionary keys are the same as in the header. For example, `REV DATE` has the key 'rev date' associated with it. The exceptions to this are the delays `INT DLY`, `SYS DLY` and `TOT DLY`. For convenience, these are further broken down.

The function takes one argument, a file name and returns a list containing the dictionary and any error messages as a single string. An empty dictionary is returned if:

1. the file cannot be opened
2. there is a formatting error in the header

If the calculated checksum does not match the value in the header, an error message is returned.

cggttslib.**MakeFileSequence**(*file1,file2*)

`MakeFileSequence` interpolates a sequence of file names between `file1` and `file2`. For example, if the two input file names are `GZAU0158.532` and `GZAU0158.537`, file names with MJDs ranging from 58532 through to 58537 are generated. The generated file names are returned as a Python list.

File names in two formats can be interpolated:

1. names in the format `MJD.ext` where `MJD` is a five digit MJD and `ext`, the file extension, is arbitrary.
2. the format recommended in the CGGTTS v2E specification eg GZAU0158.532

For a sequence to be generated, the two file names must:

1. have the same path
2. have the same extension

6.9 ppsd

`ppsd` produces a digital pulse on an I/O port, aligned with the system time. It works by sleeping until just before the second (plus any programmed delay) rolls over, and then going into a hard loop, polling the time until rollover.

Two I/O ports are presently supported: the standard PC parallel port, and SIO8186x devices. The latter are found on some single board computers. For parallel port output, all 8 bits of the data port (pins 2 to 9 on a DB37) are written to.

`ppsd` doesn't produce a log file.

6.9.1 usage

To run `ppsd` on the command line, use:

```
ppsd [option] ...
```

The command line options are:
-d run in debugging mode
-h print help and exit
-o <delay> set the PPS delay, in microseconds.
-v print version information and exit

6.9.2 configuration file

The configuration file, `ppsd.conf` contains a single number, an offset for the output 1 pps, in microseconds.

6.10 sysmonitor.pl

`sysmonitor.pl` monitors the system status and provides notification of alarm conditions via files written to a specified directory, and via calling the alarm delivery system. In particular, `lcdmonitor` reads this directory to pick up current alarms.

Some of the conditions currently monitored include:

- ☐ TIC logging running (via it's status file)
- ☐ reference oscillator logging running
- ☐ reference is locked
- ☐ reference has lost power (PRS10 only)
- ☐ GPS logging running

- ☐ GPS receiver is tracking sufficient satellites
- ☐ RAID status (where RAID is used)
- ☐ NTP reference clocks are healthy

The run time for an alarm must integrate up to the configured threshold before an alarm is issued. Similarly, the run time for a clearing alarm must integrate to zero before a clear is issued.

6.10.1 usage

`sysmonitor.pl` is normally started by the init system, for example by `systemd` on Debian.

To run `sysmonitor.pl` on the command line, use:

```
sysmonitor.pl [OPTION]
```

The command line options are:
-c <file> use the specified configuration file
-d run in debugging mode
-h print help and exit
-v print version information and exit

To manually run `okcounterd`, you may need to disable the system service and kill any running `okcounterd` process.

6.10.2 configuration file

The configuration file uses the format described in 5.3.

alarm path
This defines the directory to which alarm notifications are written.
Example:

```
alarm path = /usr/local/log/alarms
```

alarm threshold
This defines the threshold at which alarms are raised. The units are seconds.
Example:

```
alarm threshold = 60
```

alerter queue
Alarms can be delivered by other methods using `alerter`. This entry defines the queue used by `alerter`. *Example:*

```
alerter queue = /usr/local/log/alert.log
```

gpscv account
This defines the account used for GPSCV processing (and implicitly, the location of `gpscv.conf`).
Example:

```
gpscv account = cvgps
```

log file
This defines the file used for logging of sysmonitor's operation and alarm events.
Example:

```
log file = /usr/local/log/sysmonitor.log
```

ntp account
This defines the account used for NTP-related logging and processing.
Example:

```
ntp account = ntp-admin
```

ntpd refclocks
This specifies a list of sections, each of which defines an `ntpd` refclock that is to be monitored.
Example:

```
ntpd refclocks = PPS,NMEA
```

An `ntpd` refclock section looks like:

```
[NMEA]
refid = 127.127.20.0
name = NMEA
```

6.10.3 log file

`sysmonitor.pl` creates a log file. The default file is `/usr/local/log/sysmonitor.log`

6.11 gziplogs.py

`gziplogs.py` is used to manage compression of log files. Typically, it will be run once per day, after UTC0. It requires a configuration file, `gziplogs.conf`, which is expected to be in the user's `etc` directory and uses our standard format 5.3.

`gziplogs.py` doesn't produce a log file.

6.11.1 usage

`gziplogs.py` is normally run as a `cron` job. To run it on the command line, use:

```
gziplogs.py [option] ... [MJD [MJD]]
```

The command line options are:
–**config <file>, -c <file>** use the specified configuration file
–**debug, -d** run in debugging mode
–**help, -h** print help and exit
–**version, -v** print version information and exit

Either a single MJD or range of MJDs can be given. If no MJD is given, the MJD of the previous day is used.

6.11.2 configuration file

A `targets` entry is needed. Note that this is not defined within a section, for compatibility with older versions of this script.

targets
This entry defines a comma-separated list of targets. Each target defines a section in the configuration file.
Example:

```
targets = ppslogs,ntpstats
```

Within each section defined by targets, the following entries are defined

files
This entry defines a comma-separated list of files to compress. Three date specifications, delimited by parentheses, are recognized: YYYYMMDD, MJD and YYDOY.
Example:

```
files = raw/{MJD}.rx, raw/{MJD}.tic, raw/{YYYYMMDD}.dat
```

destination
This optional entry defines a directory to move compressed files to
Example:

```
destination = archive
```

Note, for compatibility, the file format used by `gziplogs.pl`, the deprecated Perl version of `gziplogs.py` is also supported.

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