T1 10MHz Time Reference

User Manual

Dear Valued Customer,

We are honored that you chose the T1 10MHz Time Reference for your audio system. Our team devoted every effort to design and manufacture this highest-quality versatile and future-proof product and is proud to present it to you. We wish you hours of enjoyment from your music collection with your T1 10MHz Time Reference installed in your system.

Before you embark on your musical journey, we kindly request your special attention regarding the information contained in this manual. The T1, as you will discover in the following pages, is a Swiss precision product designed for ultimate performance and flexibility. However, reaching sonic excellence from your audio system requires your unit to be set up and operated correctly and this what this manual is all about. If you have any questions or require assistance, please don't hesitate to contact your authorized dealer.

We hope you will enjoy your T1 for many years to come.

The Concert has just begun...

Cossy F.

Heeb T.

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1   Product highlights

CH products are rigorously designed and manufactured in Switzerland by CH Precision Sàrl. Our engineers combined their know-how, expertise and ingeniousness to present you the T1, a top performance future-proof time reference unit with Ethernet control and USB flash-drive firmware update capabilities.

The T1 is the heart of any digital audio systems. It sets the tempo of all the digital pieces of audio equipment in a system. Based around an ultra-low phase noise, high accuracy 10MHz oven controlled oscillator (OCXO), the T1 brings the pivotal timing accuracy that enables CD players, digital to analog converters and any digital audio products equipped with a SYNC input to function optimally.

The T1 features 6 configurable 75 Ohm BNC outputs, capable of individually outputting low or high level sine or square-waves. This ensures maximum compatibility with equipment capable of locking to a 10MHz clock signal. Besides, an external reference input has been provided to allow the T1 to lock on an external TTL reference signal.

Despite interfacing with digital pieces of equipment, The T1 was designed as a purely analog product, where all the internal signal paths are using analog pieces of circuitry. This ensures the T1 with the cleanest, most linear behavior from its heart to its outputs.

Oscillators are highly sensitive to temperature variations as well as to mechanical vibrations. To minimize the susceptibility to these parameters, the T1 oscillator is tightly encapsulated inside a heavy block of aluminum. In addition to benefits the unit's chassis brings, the aluminum block greatly decreases the susceptibility to temperature variations, creating an extra layer of encapsulation. Besides, the aluminum block solely rests on Alpha gel pads. Alpha gel is a soft silicone gel which works as a structure-borne vibration isolation system, while the T1 outer enclosure provides efficient airborne vibration isolation. The oscillator module is "floating" on the Alpha gel pads, preventing external mechanical vibrations from interfering with the oscillator operation. The substantial mass of the clock module coupled with the high compliance of the Alpha gel pads create a mechanical damping system capable of isolating the critical core of the clock from vibrations of frequencies as low as 15 Hz.

The T1 10MHz Time Reference can be fitted with the GPS option board. The GPS board enables the T1 to receive a reference signal from the GPS satellite system. Every clock will see its frequency drift over time. In order to maintain the clock frequency as stable as possible, one needs a signal that can be used as the reference which the oscillator can lock onto. The most stable clocks available today is the Cesium clock and the best place to it is above our heads, in satellites. The GPS option allows the T1 tot harvest the benefit of the frequency stability of Cesium clocks by locking to the GPS satellite system.
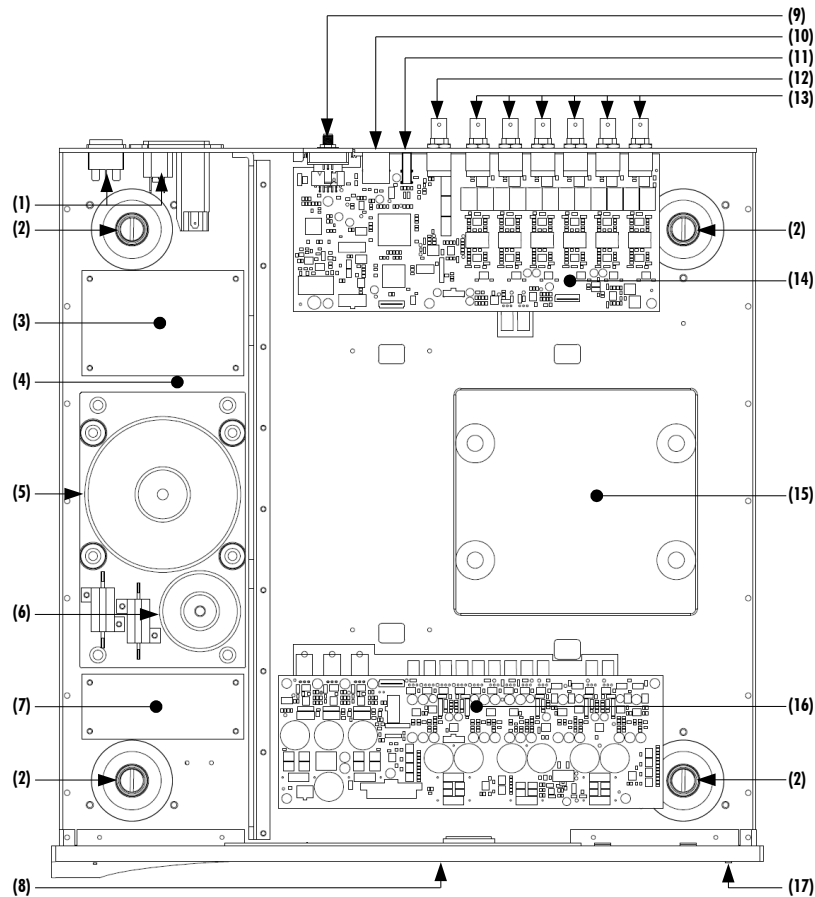
T1 main components

(1) Mains switch and power cord receptacle (on back panel)

(2) Adjustment shafts and screws

(3) Mains filter board

(4) Power supply section

(5) Main power transformer

(6) Standby power transformer (ensures green mode standby)

(7) Front panel power supply board

(8) Display (on front panel)

(9) GPS antenna SMA connector for active or passive 1.57542 GHz antenna. Only when GPS option is installed.

(10) Ethernet RJ-45 plug for control from Android app

(11) USB Type A socket for firmware update

(12) TTL level external reference input BNC connector

(13) 10 MHz 75 Ohm clock output BNC connectors

(14) Output driver board

(15) Oscillator module mounted on soft Alpha gel pads (with 4 mechanical stops for transportation purposes)

(16) Power supply regulation board

(17) User interface push-buttons

1.1   Rigorous metal work construction

The T1 10MHz Time Reference chassis is made of high-grade aluminum alloy with no visible screws on the front, top and side panels. First class mechanical and chemical surface treatments provide the luxury finish of the T1. Pin assembly of all chassis elements enables smooth joints between metal parts while screws every 6cm ensure protection against electromagnetic interferences.

The unit rests on four stainless steel feet. Each foot is fitted with an elastomer ring to sit on delicate surfaces but is also equipped with height adjustable steel spikes to fine-tune the unit's position. Horizontal leveling is accomplished using the provided screwdriver through the four adjustment shafts accessible from the top of the unit. Most importantly, the steel spikes serve as vibration evacuation channels. When used with the provided CH Support discs, they create the most effective way to channel unwanted vibrations away from the unit.

Finally, for units that are stacked on top of each other, stacking covers are provided to interface with the spikes of the unit above (see section 4.2). Vibrations from the upper unit is transmitted by the stacking cover to the shaft of the lower unit and from there to the lower unit's feet or spikes, forming a privileged path to channel unwanted vibrations away from the unit.

1.2   Power supply

The power supply inside the T1 is highly critical for the effective operation of the oscillator. The T1 power supply consists of three regulation circuits serially connected. They are applied in all the T1 critical areas. This ensures the cleanest and lowest noise power supplies for the oscillator and the output buffer circuits.

Two toroidal transformers form the AC mains area of the unit. The largest transformer is used to supply power to the local linear regulation circuits described above as well as to the interface of the unit (front panel display, microcontroller and FPGA devices that monitor the unit).

The smaller transformer is the Standby transformer to ensure green Standby mode, meeting the latest energy saving regulations. Both transformers have static shields between primary and secondary windings. They are mounted on a steel plate which is isolated from the rest of the chassis by silent blocks to prevent the transmission of vibrations to the rest of the unit.

Input AC voltage to the power supply should be set to 100V, 115V or 230V AC according to your local mains voltage.

2   System setup examples

Below are two examples of setups that can be realized with the T1. Please note that the T1 can be used with any pieces of equipment capable of locking to a 10MHz clock signal.

2.1   T1 + D1 + C1 setup

Both the D1 and C1 need to be equipped with the SYNC_IO option board.

Connect the T1 BNC output 1 to the D1 SYNC input using a low capacitance 75 Ohms coaxial cable (typically the CH Clock_link Reference cable) and terminate the cable by activating the D1 clock source to **Sync BNC 75 Ohm** from the D1 menu.

Connect the T1 BNC output 2 to the C1 SYNC input using a low capacitance 75 Ohms coaxial cable (typically the CH Clock_link Reference cable) and terminate the cable by activating the C1 clock source to **Sync BNC 75 Ohm** from the C1 menu. Please be aware that as far as clock sources are concerned, each input in the C1 can be configured independently. In this example, the D1 connects to the C1 using the CH Link input. Therefore, the clock source of the C1 CH Link input should be set to **Sync BNC 75 Ohm**.

If unused, disable the T1 BNC outputs 3 to 6 in order to minimize electromagnetic radiations.
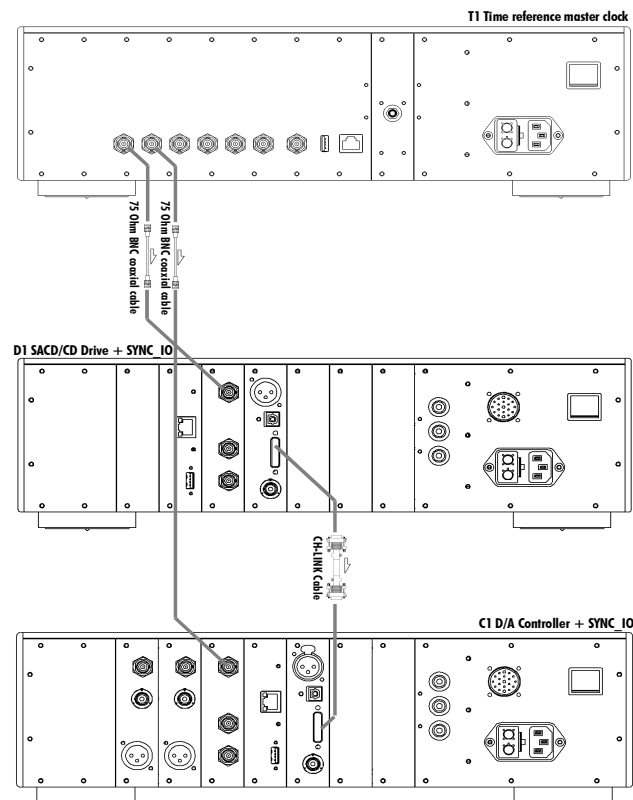
T1 + D1 + C1 setup

2.2   T1 + I1 setup

In this setup, the I1 needs to be equipped with the SYNC_IO option board.

Connect the T1 BNC output 1 to the I1 SYNC input using a low capacitance 75 Ohms coaxial cable (typically the CH Clock_link Reference cable) and terminate the cable by activating the clock source to **Sync BNC 75 Ohm** from the I1 menu.

If unused, disable the T1 BNC outputs 2 to 6 in order to minimize electromagnetic radiations.
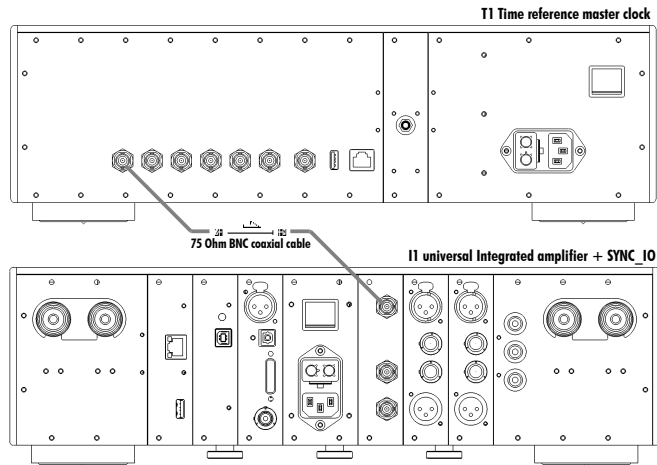

T1 + I1 setup

3 Read carefully before use

Please read this manual carefully before making connections or operating your T1. After reading this manual, please store it in an accessible place for future reference. If after reading this manual you feel unsure about how to make connections or how to operate the unit, please contact your authorized dealer for assistance.

3.1 Package content

Make sure that the package content is complete. If not, please contact your authorized dealer. Your package contains:

- The T1 10MHz Time Reference unit
- A power cord
- 4x adjustment steel spikes
- A suction cup (used to unscrew the top covers)
- An accessory box containing:
  - a spike adjustment screwdriver
  - a Torx 10 screwdriver
  - four stacking covers
  - a USB stick
  - a set of four CH Support Discs

Please store the packaging for future use. Check your T1 for any apparent damage. In case of a damage, immediately contact your authorized dealer. If your T1 is cold due to transport, please let it warm up to room temperature before powering it up.

3.2 Safety notice

Make sure to observe the following safety rules:

- Always keep the unit horizontal when handling it
- Install your unit on a stable base
- Do not install your T1 near water
- The T1 is fairly heavy, so have someone to help you when moving it
- Do not expose the unit to any kind of liquid
- Do not install it under direct sunlight or near any heat source such as radiators or other apparatus generating heat
- Do not install it in a confined space and make sure there is sufficient airflow around the unit, including under the unit
- Do not operate under high ambient temperature (>40°C) or in extremely high humidity conditions
- Only use options and accessories specified or recommended by CH Precision
- Do not open the unit nor try to service it by yourself. Always refer to a qualified technician for service, maintenance or upgrades. Failure to do so will void the unit's warranty

3.3 Mains supply

Before connecting the mains power cord, make sure that the mains voltage selection at the back of the unit matches your local mains voltage.

Make sure that your T1 10MHz Time Reference is disconnected from the AC wall socket in the following cases:

- When cleaning the unit
- During thunderstorms
- When unused for long periods of time

Also make sure your T1 is turned off when making connections (it is also highly recommended to turn off the rest of the system).

3.4 Transport and packaging

The T1 must always be stored in its original packaging for transportation. Doing so will ensure optimal level of protection for your unit. Please store all packaging in a dry and clean area for future use.

Besides, we recommend to remove the adjustment spikes and to store them in the packaging prior transportation. Vibrations during transport may cause the adjustment spikes to move from their retracted position; there could be a risk of damaging the piece of furniture the unit is installed onto if the spikes are not fully retracted.

3.5 Cleaning

Use a soft, dry cloth to clean your unit. Never use any solvent or liquids as they might damage the surface or infiltrate the unit. Please use an ultra-soft piece of fabric (for example a cloth designed to clean eyeglasses) to clean the front display area.

3.6 Maintenance and Servicing

The T1 10MHz Time Reference contains no user serviceable parts. Do not try to open, modify or repair your T1 by yourself. This will void any warranty. Your T1 10MHz Time Reference must be checked by a qualified and approved technician in any of the following cases:

- The unit is malfunctioning
- The power cord or mains plug at the back of the unit is damaged
- The unit was dropped on the floor or presents external damage
- The T1 has been exposed to liquids or unknown substances

4 Installation

4.1 Unpacking

Unpack your T1 10MHz Time Reference and store the packaging for future reference. The T1 is fairly heavy so have someone to help you when removing it from its packaging.

4.2 Unit positioning

When delivered from factory, the T1 time reference's four feet sit on elastomer rings, ensuring both scratch-protection for the base on which the unit sits, as well as safe anti-slipping unit positioning.

But a more advanced vibration-channeling mechanical coupling can be implemented, thanks to the steel spikes and the polymer support discs provided with the T1. To use this optimal coupling, simply go through the following steps:

1. Place the T1 unit on a stable base at its approximate final position, for instance in your preferred audio rack. Make sure cooling air is able to freely flow around the unit.

2. Gently lift the unit's corners and insert a support disc under each foot. The foot's elastomer ring should disappear in the support disc's groove when properly placed. Carefully check all four feet perfectly fit in each support disc before pursuing any further. The unit should stably rest on its feet at that point.

3. Unscrew the four top covers from the T1's shafts with the provided suction cup. Be careful not to scratch their delicate finish.

4. Insert the adjustment spikes into each adjustment shaft.

5. Softly screw clockwise each adjustment spikes into the shaft with the provided screwdriver, until any resistance is felt (just before the unit's corner starts to lift).

6. Then screw clockwise each spike by the same amount (for instance two full turns).

7. If the base is flat, the unit should be stable and horizontal. If not, correct the unit's stability and horizontality by turning clockwise or anti-clockwise the required spikes.

If no CH Precision unit is to be stacked on top of the T1, screw the four top covers back. Otherwise, screw the four polymer stacking caps instead, and gently lay down the unit to be stacked on top of it. Be very careful that both units are perfectly aligned in order not to scratch the T1's top plate with the other unit's feet. Repeat steps 3 to 8.
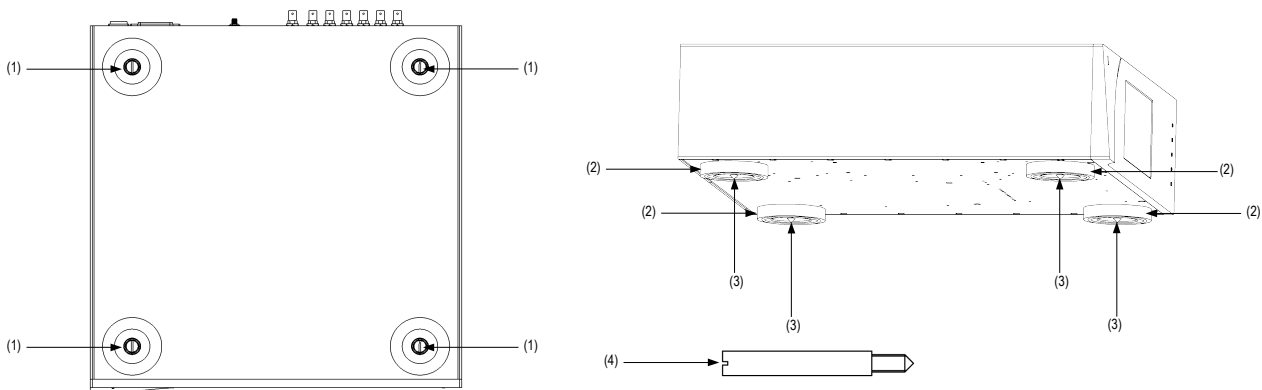
Adjustment shafts, feet and spikes

(1) Adjustment shafts. Insert the adjustment spikes and use the provided screwdriver to secure and adjust individual spikes

(2) Feet

(3) Adjustment spike heads (when inserted into the adjustment shafts)

(4) Adjustment spike

Never stack any component other than CH's on your T1. Never use the aluminum shaft covers (top covers) when another CH component is to be stacked on top of your T1.
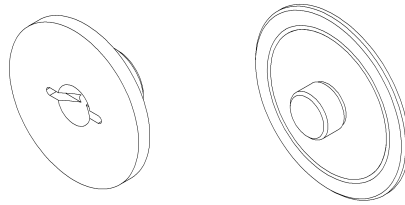
Top covers (left: stacking cover, right: top cover)

5 Connections

This section provides information on how to connect your T1 to the rest of your audio system.
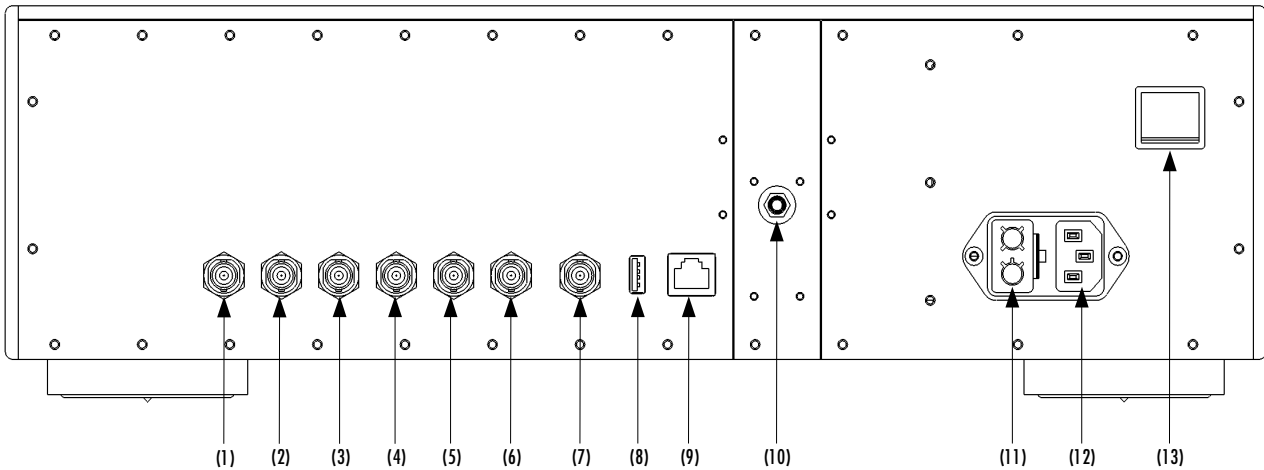
T1 rear panel connections

(1) 10 MHz 75 Ohm clock output 1 (BNC connectors)

(2) 10 MHz 75 Ohm clock output 2 (BNC connectors)

(3) 10 MHz 75 Ohm clock output 3 (BNC connectors)

(4) 10 MHz 75 Ohm clock output 4 (BNC connectors)

(5) 10 MHz 75 Ohm clock output 5 (BNC connectors)

(6) 10 MHz 75 Ohm clock output 6 (BNC connectors)

(7) TTL level reference input BNC connector

(8) USB socket for firmware update

(9) Ethernet port to interface with the CH Control app

(10) GPS antenna SMA-type connector for active or passive 1.57542 GHz antenna. Only when GPS option is installed.

(11) Power fuses and voltage selection

(12) Power cord receptacle

(13) On/Off power switch

5.1 BNC coaxial outputs

The T1 features 6 configurable 75 Ohm BNC outputs, capable of individually outputting a low or high amplitude sine or square-wave signal. This ensures maximum compatibility with equipment capable of locking on to a 10MHz clock signal.

The outputs have a 75 Ohm characteristic impedance. For best transmission efficiency, the coaxial cables connected to the T1 outputs should have a 75 Ohm characteristic impedance (typically like the CH Clock_link Reference cable). The unit on the other end of the cable, receiving the T1 clock signal should be terminated with a 75 Ohm load.

We recommend to wire your system in a point-to-point configuration, where as one T1 output will connect to one receiver only.

The outputs are transformer coupled and can be therefore seen as balanced signals.

5.2　BNC external reference input

The T1 features a high impedance BNC input used to receive an external reference. The input signal must have TTL levels.

The external reference input accepts specific frequencies: 1PPS (Pulse Per Second), 100kHz, 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz and 192kHz. The reference signal frequency maximum deviation should be smaller than ± 0.1ppm around the nominal frequency. Besides, the input signal jitter should be lower than 15 ns pk-pk.

In order to synchronize the T1 to the an external reference input signal, make sure the TRACKER SOURCE is set to EXT IN and the TRACKER STATE is set to ON in the T1's GENERAL SETTINGS menu. Please refer to chapter 7.1 for further assistance.

5.3　GPS Antenna

Like every CH Precision option currently available, the GPS synchronization option can either be ordered together with a T1, or added at a later stage. When ordered at the same time as the T1, the GPS module is factory fitted. Otherwise, it will be installed by your authorized dealer.

The GPS synchronization module is fitted with a SMA connector to connect a passive or an active GPS antenna. An active antenna is provided with CH Precision's GPS option. Please note that any off-the-shelf 1.57542 GHz GPS antenna (active of passive) fitted with an SMA connector can be used instead.

In order to synchronize the T1 to the GPS signal, make sure the TRACKER SOURCE is set to GPS and the TRACKER STATE is set to ON in the T1's GENERAL SETTINGS menu. Please refer to chapter 7.1 for further assistance.

5.4　Ethernet port

The Ethernet port is used to control the T1 unit settings via the CH Control Android app running on an Android tablet. Simply connect the T1 Ethernet port to a standard Ethernet Router (equipped with a wireless access point so it can communicate with the tablet). Use an Ethernet RJ45 Category 5 or better cable. Using the CH Android app, the T1 settings can be accessed and adjusted on the fly.

5.5　Mains socket and voltage selection

Make sure that the voltage selector at the back of the unit is set to the correct mains voltage with respect to the AC voltage at your location. Connect the power cord to the unit's mains socket and the power cord's plug to a wall socket.

5.6　USB port

The T1 unit runs a firmware that defines the unit's operation. The USB port is used to perform update to the T1 unit's firmware. The firmware update is carried out via a USB stick containing the latest version of firmware. The USB Stick is inserted at the back of the unit into the USB port and the update start command is activated via the front panel user interface.

Please note that the USB port has no other purposes than to update the T1 unit firmware. For more information about unit firmware update, please refer to section 8 of this manual.

6   Operation

The T1 10MHz Time Reference is operated either from the unit's front panel or from a tablet running the CH Control app.

6.1   Front panel
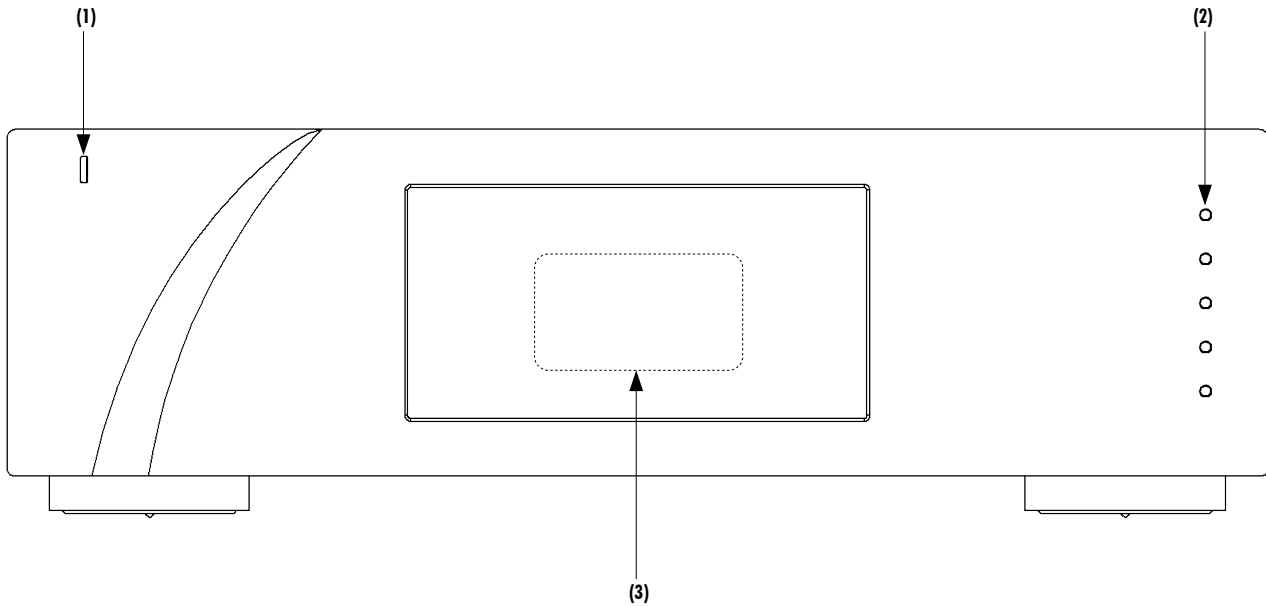
Front panel elements

(1)   Standby LED
(2)   Five user control push-buttons
(3)   Display area (high-definition display)

The standby LED lights up when the unit is in standby. It is turned off by default during operation and shortly lights up whenever it receives an IR remote control command. The LED can also be programmed to remain ON during operation. The display is a high-definition panel with very wide viewing angle, high contrast and high brightness ensuring optimal reading comfort. The color and brightness of the display can be configured according to one's taste.

6.2   Front panel push-buttons

The push-buttons located on the front panel of the T1 unit allow the user to access the unit's settings through a series of menus.
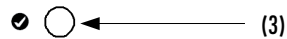
Front panel push-buttons

Button number	Button symbol	Description
1	⏻	Power ON (short push) / Power Off (long push)
2	▲	Increments through the six outputs status
3	⊘	OK / Enter Shortcut and Menu modes
4	▼	Decrements through the six outputs status
5	⊠	Cancel / Back

Front panel push-buttons description

6.3   Operating modes

The T1 10MHz Time Reference has three operating modes: Normal mode, Shortcut modes and Menu mode. Normal mode is used to display the T1 main status whereas Menu mode is used to fully configure the unit. Shortcut mode is designed for quick access to selected Menu mode items. Shortcuts are user programmable and most Menu mode items can be selected as Shortcuts.

6.3.1   Normal mode

Normal mode is used to display the T1 main status, including the settings of the outputs and whether the T1 is using an external reference signal or is locked to the GPS signal. When powered on, the T1 starts in Normal mode. The display looks as follows:
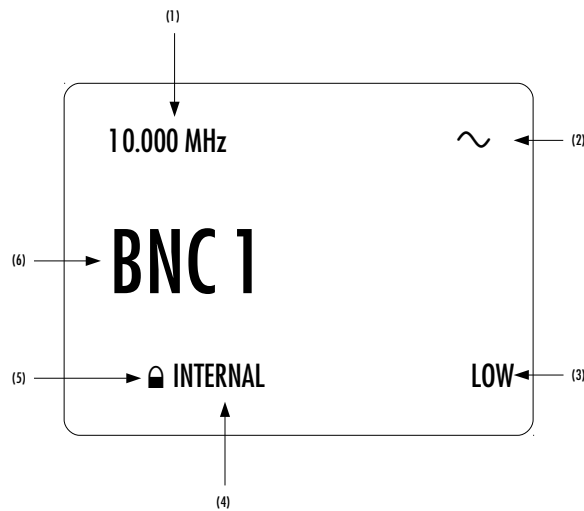
Normal mode display elements

(1) Output frequency of the T1, is always 10 MHz

(2) Output (6) waveform shape, can be sine or square

(3) Output (6) waveform shape, can be low or high

(4) External reference clock source if any (GPS or External input), internal otherwise

(5) Locking state

(6) Output with (1), (2) and (3) specifications

Displayed elements depend on the user settings. In the example above, the T1 is not synchronized to any external clock (internal mode), clock module is stable (padlock is closed). The first BNC connector outputs a low-amplitude 10.000 MHz sinewave.

Following table shows the actions of the front panel push-buttons in Normal mode.

Front face push buttons	Unit State	Unit Action
⏻, short push	STANDBY Any other state	Wakes from STANDBY No effect
⏻, long push	STANDBY Any other state	Wakes from STANDBY Goes to STANDBY
▲	Any state	Shows status of next output
⊘	Any state	Enters Shortcuts mode
▼	Any state	Shows status of previous output
⊠	Any state	No effect

Push-buttons actions in Normal mode

6.3.2 Shortcut Mode

The T1 10MHz Time Reference settings are available through a set of menus described in the next sections. However, to have quick access to the most frequently used configuration menu items, the T1 offers the concept of Shortcuts. Shortcuts are fully programmable and the user may choose almost any configuration parameter as a Shortcut. There are up to six user programmable Shortcuts available. To learn how to program individual Shortcuts, please refer to the SHORTCUTS menu item in the next section.

Shortcuts are accessed from Normal mode by a push of the OK [⊘] button on the front face. Additional OK [⊘] pushes go through the remaining Shortcuts. The last Shortcut is always dedicated to entering the Menu mode (SETUP). On this last Shortcut, an OK [⊘] push will return to Normal Mode and an UP [▲] push will enter the Menu mode. The parameters for a given Shortcut are modified using the UP [▲] or DOWN [▼] buttons. The unit reverts to Normal mode if no user action take place for 10 seconds.

The following table shows the actions of the push-buttons in Shortcut mode.

Front face push buttons	Unit State	Unit Action
STANDBY [⏻] Long Push	Any state	Goes to STANDBY (power off)
UP [▲]	Shortcuts (except last) Last Shortcut (SETUP)	Modifies parameter up (when available) No action
OK [⊘]	Shortcut (except last) Last Shortcut (SETUP) or after current Shortcut has been modified	Skips to next Shortcut Exits Shortcuts mode (Normal mode)
DOWN [▼]	Shortcuts (except last) Last Shortcut (SETUP)	Modifies parameter down (when available) Enters Menu mode
CANCEL [⊠]	Shortcuts	Exits Shortcuts mode (Normal mode)

Push-buttons actions for Shortcuts

The COLOR Shortcut gives a good illustration of how to navigate a Shortcut screen. Navigating other Shortcuts is similar.
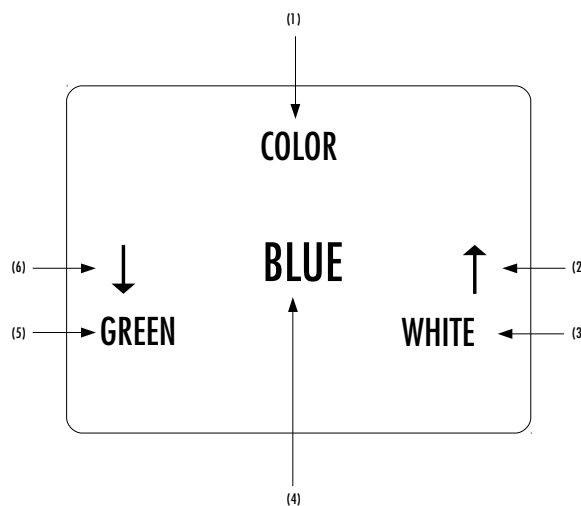
COLOR Shortcut display elements

(1) Shortcut title (Parameter being adjusted)

(2) Arrow indicating UP button [▲] if applies. The item below indicates the next parameter value (up direction)

(3) Next Parameter Value if UP button [▲] is pushed (parameter up)

(4) Current Parameter Value

(5) Next parameter value if DOWN button [▼] is pushed (parameter down)
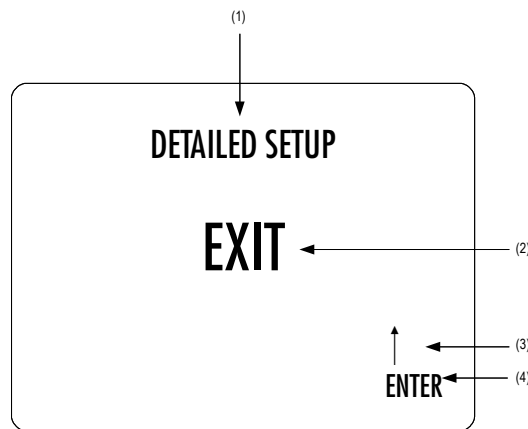
(6) Arrow indicating DOWN button [▼] if applies. The item below indicates the previous parameter value (down direction)

The last Shortcut (SETUP) is always the same and cannot be removed or altered. It gives access to the Menu mode and the detailed setup of the unit.

DETAILED SETUP Shortcut screen

(1) Shortcut title. It indicates that Detailed Setup (Menu mode) can be entered at this stage

(2) Current value of the parameter. Default action is to exit (go back to Normal mode)

(3) Arrow indicating UP button [▲]

(4) Next parameter value. If UP button [▲] is pushed, the unit enters into Menu mode

6.3.3 Menu mode

The Menu mode allows the Configuration and Setup of the T1. Menu mode is entered from the last Shortcut item (see above). From Normal mode, enter the Shortcut mode by pushing the OK [⏻] button. By successive OK [⏻] button pushes, step to the last Shortcut item (DETAILED SETUP) and push the TOP [▲] button once to enter the Menu mode.

Navigation in Menu mode is based on UP [▲] and DOWN [▼] buttons to select an item or to change a value. The OK [⏻] button is used for validation and CANCEL [✗] is used to go back to the parent level or to exit without saving.

Front face push buttons	Unit Action
STANDBY [⏻] Short Push	No action
STANDBY [⏻] Long Push	Put the unit into Standby
UP [▲]	Move to next menu item upward
OK [⏻]	Enter next menu level or Validate choice (save setting)
DOWN [▼]	Move to next menu item downward
CANCEL [✗]	Return to parent menu without saving

Push-button actions in Menu mode

The following illustration shows the elements of a the T1 SETUP Menu page, the entry point of the T1 menu structure.

(1)

T1 SETUP

GENERAL SETTINGS	>	Output state
DISPLAY SETTINGS		Output waveform
SHORTCUTS		Output level
FACTORY SETTINGS		Output name
INSTALLED OPTIONS		Tracker state
NETWORK		...

(3)   (2)
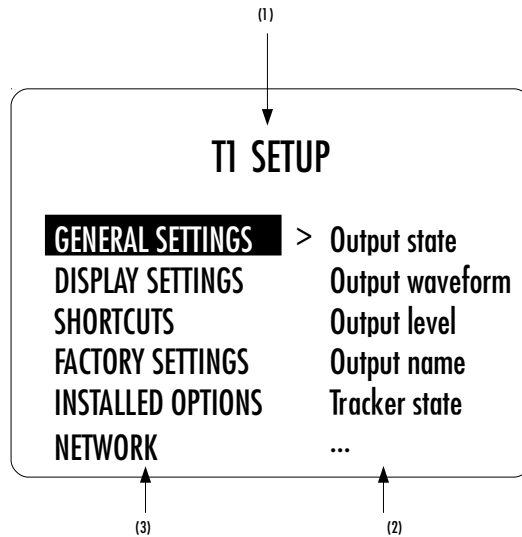
T1 SETUP screen items

(1) Menu title. When entering a menu item, the title also shows the parent menu. If the GENERAL SETTINGS menu is entered, the title line would display T1 SETUP >> GENERAL SETTINGS.

(2) Shows the available parameters when entering the currently highlighted menu item. In this example, GENERAL SETTINGS is highlighted and the second column shows the parameters available in the GENERAL SETTINGS menu.

(3) The list of items in the current menu. Navigate from one item to the other by pressing the UP [▲] and DOWN [▼] buttons. To enter the highlighted menu item, press the OK [◉] button. To return to the previous menu level press the CANCEL [⊠] button. In this example, the CANCEL [⊠] button exits the Menu mode and sets the unit back to Normal mode.

Once a menu item is selected by a push of the OK [◉] button, parameters for the corresponding menu item can be navigated and accessed. As an example, the following drawing shows the display elements of the T1 SETUP >> GENERAL SETTINGS sub-menu.

(1)

T1 SETUP >> GENERAL SETTINGS

OUTPUT STATE	...
OUTPUT WAVEFORM	...
OUTPUT LEVEL	...
OUTPUT NAME	...
TRACKER STATE	Off
TRACKER SOUCE	GPS

(3)   (2)
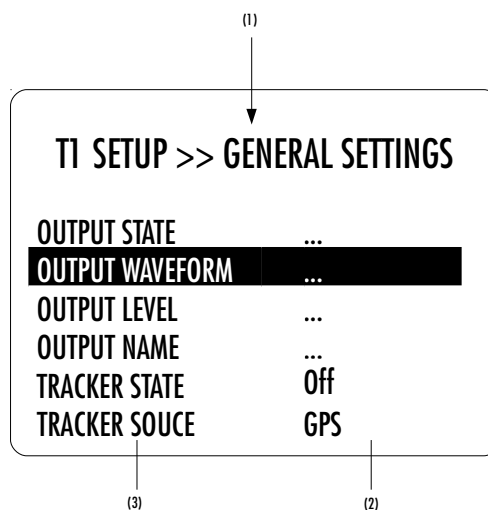
T1 SETUP >> GENERAL SETTINGS menu items

(1)   Menu title. T1 SETUP >> GENERAL SETTINGS shows that the parent menu is T1 SETUP. By pushing the CANCEL [⊠] button, the unit returns to the parent menu.

(2)   This is the Parameter Value column. For each item in the Parameter column, the Parameter Value item on the same line indicates the current value of the Parameter.

(3)   This is the Parameter column. The currently active Parameter is highlighted. Use the UP [▲] and DOWN [▼] buttons to navigate from Parameter to Parameter, and the OK [⊘] button to enter the edition mode of that parameter.

Once a terminal Parameter (e.g. a Parameter not giving access to a further sub-menu) is selected by pushing the OK [R] button, the T1 displays the corresponding Parameter adjustment screen. The following example shows the GENERAL SETTINGS >> OUTPUT WAVEFORM >> BNC 1 Parameter adjustment screen. Other Parameters are similar but may show more (or less) choices for the Parameter value. Once a Parameter is set to the desired value, an OK [⊘] button push saves the new Parameter Value and goes back to the parent level (save and exit). On the other hand, a CANCEL [⊠] button push goes back to the parent menu (in the case of this example: GENERAL SETTINGS >> OUTPUT WAVEFORM), but any modification of the Parameter Value is discarded (exit without saving).

(1)

OUTPUT WAVEFORM >> BNC 1

BNC 1   Square   (2)
             Sine   (3)

GENERAL SETTINGS >> OUTPUT WAVEFORM >> BNC 1 menu items
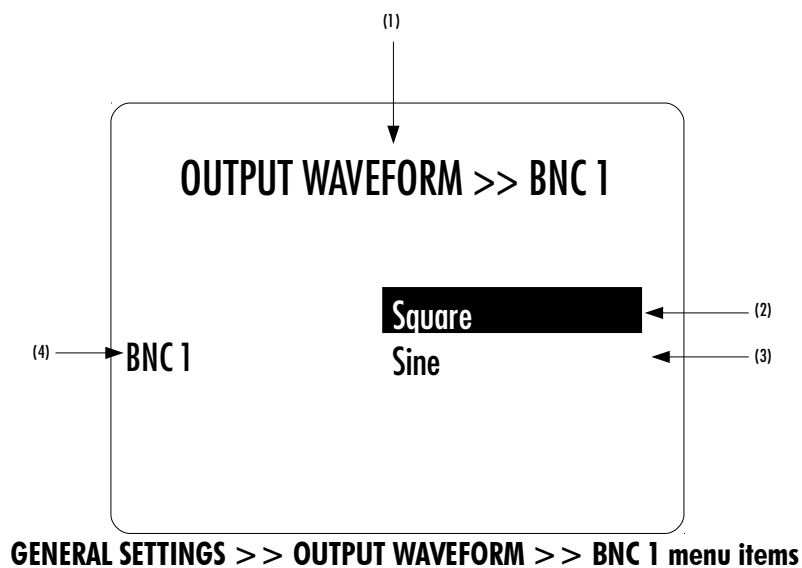
(1)   Menu title. OUTPUT WAVEFORM >> BNC 1 shows that the parent menu is OUTPUT WAVEFORM. To access the parent menu, push the CANCEL [⊠] button

(2)   The current Parameter Value is highlighted. Push the UP [▲] or DOWN [▼] buttons to navigate through Parameter Values

(3)   Other possible Parameter Value(s). Number of other Parameter Value(s) depends on Parameter

(4)   Parameter for which the Parameter Value can be modified in the current menu.

7   The T1 menus

Configuration of your T1 is accomplished by setting up parameters in the Menu mode (see chapter 6 on how to access the Menu mode and how to navigate through menu items).

Please note that configuring your T1 can also be done on a tablet using the CH Control Android app. Please refer to chapter 5.4 for more information about how to link the T1 to your tablet. Besides, for more information about the CH Control app, please visit our Facebook page (www.facebook.com/chprecision) where you can watch a video describing the main features of the CH app.

There are six main menus used to configure the T1 :

- GENERAL SETTINGS: Allows to adjust signal related parameters, as well as tracking behavior
- DISPLAY SETTINGS: Allows to adjust the front panel display related parameters
- SHORTCUTS: Allows to assign and modify Shortcuts for user interface customization
- FACTORY SETTINGS: Indicates the software version and allows to update it. Also allows to return to default factory settings
- INSTALLED BOARDS: Indicates which boards are installed
- NETWORK: Provides information about the Ethernet network setup and enables its configuration

7.1   GENERAL SETTINGS menu

PARAMETER	PARAMETER VALUES	REQUIRED OPTIONS	REMARKS
OUTPUT STATE	Off On	None	Individually selectable for each of the 6 outputs.
OUTPUT WAVEFORM	Square Sine	None	Individually selectable for each of the 6 outputs.
OUTPUT LEVEL	Low High	None	Individually selectable for each of the 6 outputs.
OUTPUT NAME	*Any string*	None	Used to rename any output in the T1
TRACKER STATE	Off On	None	Synchronize the T1 to an external clock source (on) or run free (off)
TRACKER SOURCE	GPS EXT IN	Only EXT IN is available if the GPS module is not installed	Allows to chose the synchronization source.

7.2   DISPLAY SETTINGS menu

PARAMETER	PARAMETER VALUES	REQUIRED OPTIONS	REMARKS
DISPLAY MODE	Status Off	None	Selects what to display when the unit is idle for several seconds: General status page or turn off the display.
LED ON/OFF	On Off	None	Allows to select if the front panel LED is on or off when the T1 is on
BRIGHTNESS NORMAL	10% 20% ... 100%	None	Sets the display brightness when the unit is operated.
BRIGHTNESS DIMMED	10% 20% 30%	None	Sets the display brightness when the unit is left idle for several seconds.
COLOR	Red Green Blue White Yellow Magenta Cyan Custom color Edit custom color	None	Selects the color of the displayed texts Custom color is a user definable color. To Edit the custom color select the Edit custom color Value. Sub-menus allow to individually configure Red, Green and Blue components (RGB) of the custom color.
GAMMA	RBG and global brightness gamma curve correction, +/-30%	None	Fine adjustment the gamma scale of the RGB components of the display. Allows to have perfectly dark background and to match other CH Precision unit's display color, even at low brightness

7.3   SHORTCUTS menu

PARAMETER	PARAMETER VALUES	REMARKS
SHORTCUT 1	Most Parameters of the GENERAL SETTINGS and DISPLAY SETTINGS menus or None	If SHORTCUT 1 is not defined, Parameter value for SHORTCUT 1 is set to 'None'. SHORTCUT 2 to 6 are not displayed in this case.
SHORTCUT 2	Most Parameters of the GENERAL SETTINGS and DISPLAY SETTINGS menus or None	If SHORTCUT 2 is not defined, Parameter value for SHORTCUT 2 is set to 'None'. SHORTCUT 3 to 6 are not displayed in this case.

SHORTCUT 3	Most Parameters of the GENERAL SETTINGS and DISPLAY SETTINGS menus or None	If SHORTCUT 3 is not defined, Parameter value for SHORTCUT 3 is set to 'None'. SHORTCUT 4 to 6 are not displayed in this case.
SHORTCUT 4	Most Parameters of the GENERAL SETTINGS and DISPLAY SETTINGS menus or None	If SHORTCUT 4 is not defined, Parameter value for SHORTCUT 4 is set to 'None'. SHORTCUT 5 and 6 are not displayed in this case.
SHORTCUT 5	Most Parameters of the GENERAL SETTINGS and DISPLAY SETTINGS menus or None	If SHORTCUT 5 is not defined, Parameter value for SHORTCUT 5 is set to 'None'. SHORTCUT 6 is not displayed in this case.
SHORTCUT 6	Most Parameters of the GENERAL SETTINGS and DISPLAY SETTINGS menus or None	If SHORTCUT 6 is not defined, Parameter value for SHORTCUT 6 is set to 'None'.

7.4   FACTORY SETTINGS menu

PARAMETER	RELATED ACTION/VALUE	REQUIRED OPTIONS	REMARKS
FIRMWARE VERSION	*Firmware version*	None	*Firmware version* indicates the version of the current firmware. Format is *x.y*. Read only parameter.
UPDATE FIRMWARE	Update	None	Selecting 'Update' launches the T1 firmware update process. A USB flash disc drive with a valid set of firmware must be inserted in the Type A USB port
RESET ALL SETTINGS	Reset	None	Selecting 'Reset' returns the T1 to its factory settings.
SERIAL NUMBER	*Serial number*	None	*Serial number* indicates the serial number of the T1. Read only parameter.

7.5   INSTALLED OPTIONS menu

PARAMETER	PARAMETER VALUES	REMARKS
ETHERNET SLOT	Control	Parameters are Read Only
GPS SLOT	- GPS	

7.6 NETWORK menu

PARAMETER	PARAMETER VALUES	REQUIRED OPTIONS	REMARKS
STATUS	IP address Product type MAC address	Connection to a router via its RJ-45 Ethernet port	List of CH Precision devices and Android remote controls detected by the T1 (product type, IP and MAC addresses) Read Only parameters
ROLE	Offline Online	Connection to a router via its RJ-45 Ethernet port	When physically connected to a network, the T1 can ignore this network (offline) or connect to it (online)
ROOM NUMBER	1 … 7	Connection to a router via its RJ-45 Ethernet port	Define the room in which room the T1 is for multiroom applications. This prevents CH Precision units connected to the same network but located in different systems/rooms to interact with each others.
IP SETTINGS	Auto (DHCP) Direct-Link Manual	Connection to a router via its RJ-45 Ethernet port	Auto should be selected if the T1 is connected to a router with DHCP server feature.
WAKE-ON-LAN	No Only if PoE Yes	Connection to a router via its RJ-45 Ethernet port	If No is selected, the T1 can't be woken up by the app. Standby mode will consume less than 0.5W. When Only if PoE is selected, the T1 can only be waken by the app if connected to a Power-over-Ethernet switch. Standby mode will draw less than 0.5W from the mains plug. If Yes is selected, the T1 can always be woken up by the app. Standby mode will draw a couple of watts from the mains plug.
POWER OFF COMMAND	No Yes	Connection to a router via its RJ-45 Ethernet port	When "No" is selected, the T1 ignores "power off" commands received through the network. This is useful as the T1 is meant to remain powered on at all time to reach higher frequency accuracy when tracking a GPS signal.
NETWORK KNOWLEDGE	Clear	None	Clears the T1's memory of other CH Precision devices it has discovered through the TCP/UDP proprietary protocol.

8   Firmware update

8.1   Preparing the USB Stick

The firmware of all the CH Precision units can be updated using the USB port located at the back of the unit. Before starting the firmware update, it is necessary to load a USB stick with files containing the new firmware. Use a FAT32 formatted USB 2.0 stick. Please note that some USB sticks might not be detected by the T1 USB port. CH Precision recommends the use of Sandisk USB 2.0 sticks such as the one delivered with the unit.

The following procedure describes how to load the USB stick with the correct files:

1. Download the latest T1 firmware file from www.ch-precision.com

2. Decompress the `.zip` file and copy the decompressed files to the root of your USB stick. After doing so, your USB stick should contain the following files:

- `T1_xxx.ds1`

- `T1_xxx.mc1`

- `T1_xxx.ol1`

where '`xxx`' indicates the firmware revision.

Make sure all three files are present at the root of your USB stick. Any missing file will make the firmware update procedure fail.

8.2   Updating the unit's firmware

1. Perform the operations described in section 8.1

2. Connect the USB stick to the USB port located at the back of your T1 unit

3. Navigate to the FACTORY SETTINGS menu (see section 6) and select the UPDATE FIRMWARE item

4. Start the Firmware Update process by pushing the OK (⊘) button. Please note that the unit will perform a Reset (the display briefly turns off and on) during the procedure

5. Once the firmware update is complete, the unit automatically goes into Standby mode. Remove the USB stick and turn the unit on. The new firmware is now active. To verify that the firmware update is effective, navigate to the FACTORY SETTINGS menu and select the FIRMWARE VERSION item. The displayed firmware revision should match the firmware revision on the files copied to the USB stick

Note: The firmware update process lasts several minutes, **do NOT interrupt it!**

When performing a firmware update, do NOT press any of the unit's front panel push-buttons, do NOT unplug the unit from the AC wall socket and do NOT turn the mains power switch off. Interruption of the firmware update procedure may result in corrupted firmware and a malfunctioning unit. In case something went wrong during a firmware update and the unit is malfunctioning, apply the emergency firmware update procedure described in the next section.

8.3   Emergency firmware update procedure

Perform the following Emergency Firmware Update procedure if your unit doesn't power up normally.

1. Perform the operations described in section 8.1

2. Power the unit off (back panel mains power switch to OFF)

3. Push and keep the STANDBY (⏻) button pushed and power up the unit (back panel mains power switch to ON). Keep the STANDBY (⏻) button pushed for a couple more seconds after you turned the unit on.

4. The unit performs the emergency firmware update. Once the operation is complete, the unit automatically goes into Standby mode. Remove the USB stick and turn the unit on. The new firmware is now active. To verify that the firmware update is effective, navigate to the FACTORY SETTINGS menu and select the FIRMWARE VERSION item. The displayed firmware revision should match the firmware revision on the files copied to the USB stick

5. If the emergency firmware update procedure fails, try the same procedure again using a different USB stick. If the failure persists, turn off your unit and contact your authorized dealer for assistance.

Note: The emergency firmware update procedure lasts several minutes, **do NOT interrupt it!**

9 Troubleshooting

Error	Action
No power	Check the AC power cord Check the power switch at the back of the unit Check the mains fuses in the AC power cord receptacle
The receiver unit is not locking to the T1	Check that the receiver unit is capable of handling 10MHz clock signals (all the CH digital units are able to receive 10MHz synchronization clocks) Check that the outputs are turned on (Output State is ON) Experiment with low and high output levels and sine or square-waves Make sure that the receiver unit has the 75 Ohm termination load activated Try with various 75 Ohm BNC cables
Lost in the settings?	Restore the default factory setting and start your setup again (MAIN MENU → FACTORY SETTINGS → RESET ALL SETTINGS)
Firmware update fails	Perform the emergency software update procedure
USB stick for firmware update is not detected	Try another brand of USB 2.0 stick. CH Precision recommends the use of Sandisk USB 2.0 sticks

Troubleshooting

If the problem persists, disconnect the unit from the AC wall socket and from the rest of your system and contact your authorized dealer for assistance.

10   Specifications

General	
User control	Front panel push-buttons and/or CH Control Android app
Display	480 × 272 24bits RGB AMOLED
Power supply	Selectable 100V, 115V or 230V AC, 47Hz to 63Hz
Power consumption (Standby)	< 1W
Power consumption (Normal operation)	Max 60 Watts
Operating conditions	Temperature: +5C to +35C, humidity: 5% to 85% (no condensation)
Dimensions (W x D x H)	440mm x 440mm x 120mm (main body) 440mm x 480mm x 133mm (overall including connectors and feet)
Weight	20kg
Firmware update / Control	USB port for firmware update / Ethernet based system control
75 Ohm BNC outputs	
Absolute frequency	10MHz
Frequency accuracy	± 0.05ppm, stand alone mode
	± 0.001ppm, with GPS option locked for 1 hour
Shape	sine-wave / square-wave
Peak to peak levels (loaded with 75 Ohms)	Low level setting: 500mV; high level setting: 1V
High impedance reference BNC input	
Input Level	5V TTL
Input impedance	47 kOhm
Accepted reference signal frequencies	1PPS, 100kHz, 44.1kHz, 48kHz, 88.2kHz, 96kHz, 176.4kHz and 192kHz
Reference signal frequency maximum deviation	± 0.1ppm around the above the reference signal frequencies

Design and Specifications are subject to change without notice. Weight and dimensions are approximate

Illustrations are informative only and may differ from the actual production model

Enclosure designed by Mana Ishoni

FCC-Notice

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However there is no guarantee that interference will not occur in a particular installation.

If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- adjust or relocate the receiving antenna

- increase the separation between the equipment and the receiver

- connect the equipment into a mains outlet on a circuit different from that to which the receiver is connected

- consult the dealer or an experienced ratio/TV technician for help

Disposal – Environmental care

Directive 2002/96/EG of the European Parliament requires consumer electro-technical appliances to be disposed separately and have to be indicated with the following symbol. Should you dispose this component please do so in conformity with local and global legal and environmental regulations and according to best practices. We strongly encourage you to recycle any batteries used with this component.