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# **X1 External Power Supply**

## User Manual





Dear Client,

We are honored that you have chosen the CH X1 External Power Supply to take your existing CH Precision setup to the next level. Our team made every effort to design and manufacture this top quality product and is proud to present it to you. We hope your X1-powered system will bring you countless hours of emotion from your musical collection.

Before you start your musical journey, we kindly ask you to pay attention to the information contained within this manual. The X1, as you will discover in the following pages, is a Swiss precision product designed for ultimate performance. However, in order to reach sonic excellence, your unit needs to be setup 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 CH Precision system for many years.

The Concert has just begun...

Cossy F.

A blue ink signature, appearing to be 'Cossy F.', written in a stylized, cursive-like font.

Heeb T.

A blue ink signature, appearing to be 'Heeb T.', written in a stylized, cursive-like font.





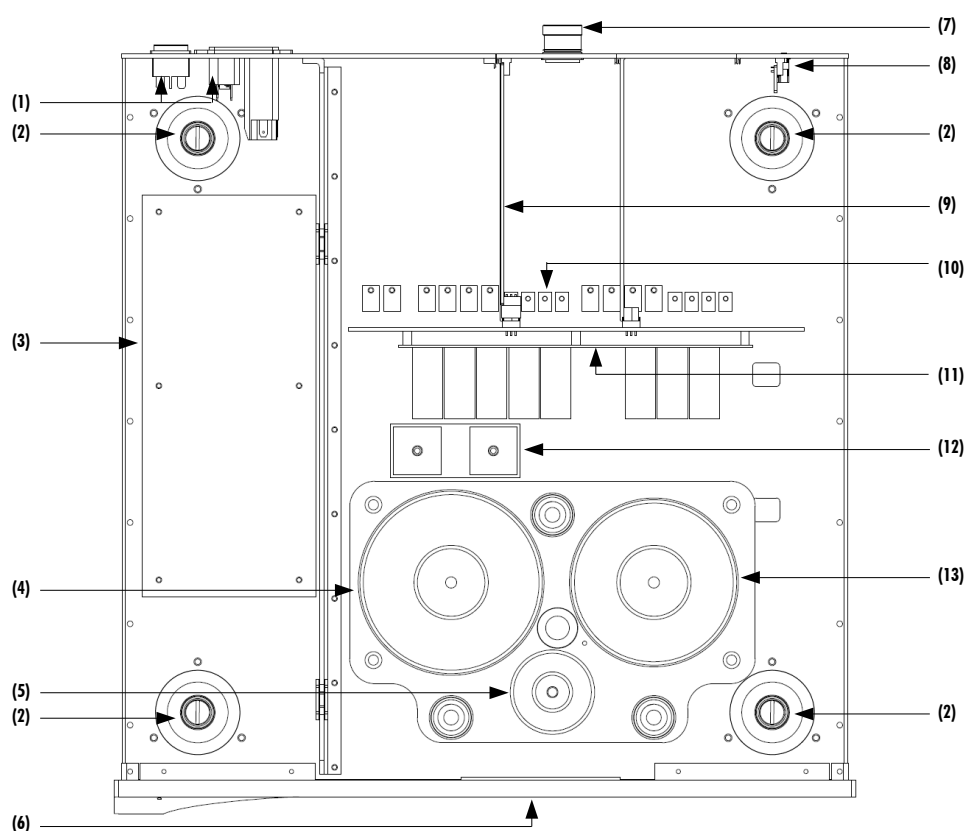
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# 1 Technical highlights

CH products are proudly designed and manufactured in Switzerland by CH Precision Sàrl. Our engineers have put all their know-how and ingenuity to bring you the X1, a top performance, ultra low-noise, high current capable, DC-regulated external power supply capable of powering up to two CH Precision units.

An X1 fitted with two regulation boards can be used to power two CH Precision devices simultaneously (such as a C1.2 controller, a D1.5 disc transport, a L1 line preamplifier or a P1 phono stage), with the advantage of dedicated transformers for analog and digital sections, and cascaded voltage regulation. However, for ultimate performance, the X1 can be dedicated to power a single CH Precision unit.



**X1 main components**

- (1) Mains switch and power cord receptacle (on back panel)
- (2) Adjustment shafts and screws
- (3) High noise-rejection mains filter
- (4) Digital power supply transformer
- (5) Standby power transformer (ensures green mode Standby)
- (6) PМОLED display (on front panel)
- (7) Power supply output connectors (one or two per X1), must be connected to C1.2 and/or D1.5 and/or L1 and/or P1
- (8) USB A-type receptacle for firmware update

- (9) Power supply regulation boards (one or two per X1)
- (10) Motherboard
- (11) Filtering board
- (12) Rectifiers
- (13) Analog power supply transformer

## 1.1 Electrical characteristics

The X1 is a high grade linear power supply delivering the analog and digital DC power supplies required by a C1.2, D1.5, L1 and a P1 on high current capable M23 19-poles connector(s). Input AC voltage can be set to 100V, 115V or 230V AC to accommodate local mains supply.

### 1.1.1 Mains filtering

The X1 transformer primary windings are individually filtered by massive RLC balanced networks. Both common mode and differential harmonics and background noise get heavily attenuated. The critical analog power supplies are therefore isolated from the noisy digital power supplies, leading to unprecedented micro-dynamics and signal-to-noise ratio.

### 1.1.2 Transformers

X1 houses no less than 3 magnetically shielded toroidal transformers, with static shields between primaries and secondaries:

- An overspecified transformer is dedicated to analog power supplies, holding multiple sets of secondary windings (one of them being exclusively used generate the purest Masterclock signal)
- The second overspecified transformer is dedicated to digital power supplies, capable of delivering high current peaks required by high performance DSPs and FPGAs, without radiating noise
- A tiny transformer is used as standby transformer to ensure green standby mode, meeting the latest energy saving regulations

All three transformers are mounted on a separate steel plate which is isolated from the main aluminium base plate through silent blocks.

### 1.1.3 Rectifying and filtering secondary windings

A large array of low ESR capacitors follows fast switching rectifier bridges on all secondary windings. This creates a proper energy reservoir responding extremely fast to high current demands, ensuring the transformers work under minimal stress condition, leading to less radiated noise and excellent component preservation over time.

### 1.1.4 Discrete regulation

Discrete (power-transistor and op-amp based) ultra low noise regulators are used throughout the regulation stages of the X1 and special care has been paid to the Masterclock power supply, which is completely decoupled from all other power supplies. This ensures an ultra-low jitter clock source for the whole system.



When the X1 external power supply is connected to a CH Precision device, the latter's internal power supply is turned off (only the standby transformer remains active, requiring its mains lead to remain plugged in). Turning the internal power supply off ensures that no power supply induced noise or radiations are generated inside that unit, thus permitting optimal operating conditions for the circuitry.

Moreover, all DC-regulated voltages delivered by the X1 get regulated once more inside the CH Precision unit it powers, leading to vanishingly low noise floor.

## 1.2 Mechanical construction

The X1 external power supply is assembled from high-quality aluminium and steel elements with no visible screws on the front, top and side panels. The front panel, base, side panels and top cover are machined from aluminium. The mains filtering section is isolated from the rest of the machine in a dedicated compartment to avoid any contamination of unclean power distribution grid to the secondary windings of the transformers by radiated noise. Pin assembly of all chassis elements provides smooth joints between elements while screws every 6cm ensures protection against electromagnetic interferences. First class mechanical and chemical surface treatments provide the luxury finish of the X1.

Four steel feet support the unit. Each feet ends with a elastomer ring to sit on delicate surfaces but is also equipped with a height adjustable steel spike to fine tune unit positioning. Horizontal adjustment is done with the provided screwdriver through the four adjustment shafts accessible from the top of the unit. In addition to providing convenient horizontal adjustment from the top of the unit, the shafts also serve as vibration evacuation channels for any stacked unit. Special shaft covers are provided to interface with the spikes of the stacked unit. Any vibration from the upper unit is transmitted by the shaft cover to the shaft and from the shaft to the lower unit feet or spike, forming a privileged path for vibrations evacuation.



## 2 Before use

Please read this manual carefully before making connections or operating your X1. 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.

### 2.1 Package content

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

- The X1 external power supply unit
- One or two Power Link Cables (configuration-dependent)
- A power cord
- Four 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 containing the latest CH Precision firmwares.
  - four CH Support Discs

Please store the packaging for future transportation. Check your X1 external power supply for apparent damages. In case of damage, please contact your authorized dealer. If your X1 is still very cold following transport, please let it warm up to room temperature before powering it up (in order to avoid condensation inside the unit).

### 2.2 Safety notice

Make sure to observe the following rules:

- Always handle with care. The X1 external power supply unit is very heavy, so have someone help you when moving it around. Improper handling of the load could lead to risk of injury.
- Install your X1 external power supply on a stable base.

- Do not install your X1 external power supply unit near water.
- Do not expose the unit to any kind of liquid
- Do not install in direct sunlight or near any heat source such as radiators or other apparatus generating heat
- Do not install in a confined space and allow sufficient airflow around the unit
- Do not operate under high ambient temperature ( $>35^{\circ}\text{C}$ ) or with extremely high humidity such as in humid cellars
- Only use options and accessories specified or recommended by the manufacturer
- Only connect CH Precision compatible devices (such as C1.2, D1.5, L1 or P1)
- Do not open the unit nor try to service it. Do not install any option board yourself. Always refer to a qualified technician for service, maintenance or hardware upgrades. Failure to do so will void the unit's warranty

## 2.3 Changing fuses and operating voltage

- To change the fuses, switch off the X1 and remove the power cable. The fuse holder is located to the right of the IEC power input. See diagram on page 15 (Arrow 8)

Fuse values vary with operating voltage:

230VAC — Fuse A : T50mA/250Vac. Fuse B : T2.5A/250Vac

100/115VAC — Fuse A : T100mA/250Vac. Fuse B : T5A/250Vac

- Never change the selectable voltage during operation. To change operating voltage, switch off the X1 and remove the power cable.

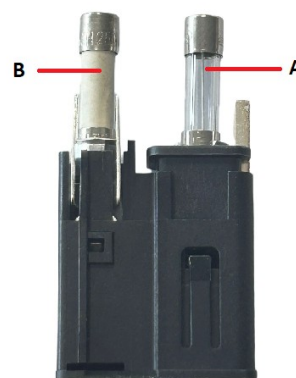
**Before changing the operating voltage first check the local voltage.**

To change the operating voltage, remove the fuse holder from the X1 chassis.

Fuse A (see picture above) is located in a sleeve that can be slid out of the body of the fuse holder: by turning the sleeve and reinserting it, the orientation of the contact pins is altered, switching the operating voltage. The selected voltage will appear in the small window in the base of the fuse holder.

Make sure that if required, you change the fuse values to match the new voltage (as above).

You can now reinsert the fuse holder.





## 2.4 User manual

Please read this manual carefully before making connections or operating your X1 external power supply. Keep this manual at hand for future reference. If after reading this manual you feel unsure of how to make connections or how to operate the unit, please contact your local authorized dealer.

## 2.5 Mains supply

Make sure to use 3 terminals (phase, neutral and earth) power cords. Make sure that the mains voltage selection at the back of the unit matches your local mains voltage.

Always disconnect your X1 external power supply from the AC wall socket in the following cases:

- When making connections (it is also recommended to disconnect the rest of the system from AC wall power)
- When cleaning the unit
- During thunderstorms
- When unused for a long period of time

Make sure your X1 external power supply is disconnected from other CH Precision devices when running a self-test.

## 2.6 Transport and packaging

The X1 external power supply must always be stored in its original packaging for transportation. Doing so will ensure optimal level of protection to your unit. Therefore, keep the packaging in a dry and clean place for future use.

Besides, we recommend to remove the adjustment spikes and to put them into the X1 box for transportation. Indeed, vibrations during transport may cause the adjustment spikes to move from their fully retracted position. There is a risk of scratching the piece of furniture the unit is installed onto if the spikes are not fully retracted.

## 2.7 Cleaning

Use a soft, dry towel or cloth for cleaning. Never use any solvent or liquids as they may damage the surface or penetrate inside the unit.



## 2.8 Maintenance and service

The X1 external power supply contains no user serviceable parts. Do not try to open, modify or repair your X1 yourself. This will void any warranty. Your X1 must be checked by a qualified technician in any of the following cases:

- The unit is not functioning properly
- The mains cable or the power cord receptacle is damaged
- The Power Link Cable or M23 19-poles connector is damaged
- The unit has been dropped or presents external damage
- The X1 has been exposed to liquids (such as rain) or unknown substances

## 3 Installation

### 3.1 Unpacking your unit

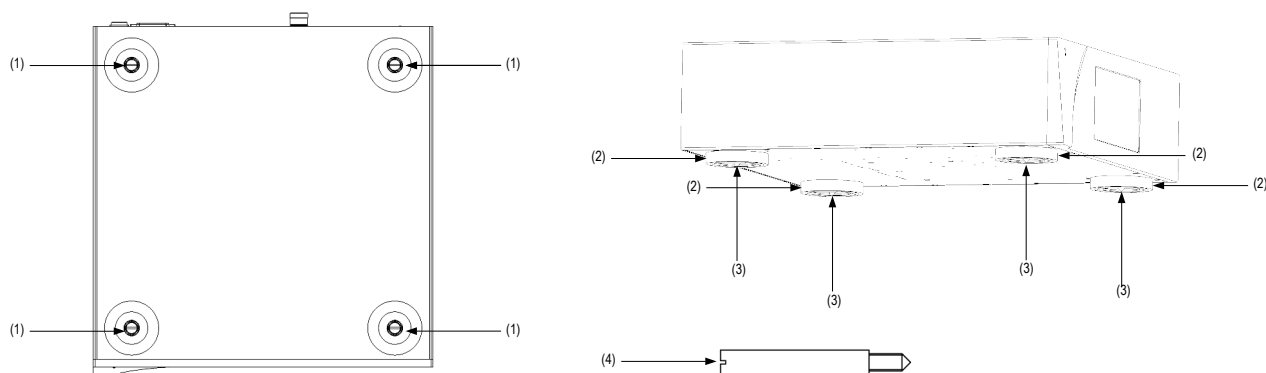
Unpack the X1 external power supply and store the packaging for future transportation. Be careful when lifting the X1 as the unit is heavy (over 20kg). Get someone to help you if necessary. When unpacking and installing the X1, take care not to damage the high quality surface treatments.

### 3.2 Positioning your unit

When delivered from factory, the X1 external power supply'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 X1. To use this optimal coupling, simply go through the following steps:

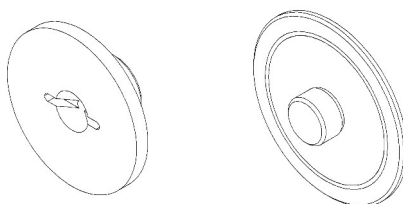
1. Place the X1 unit on a stable base at its approximate final position, for instance in your preferred audio rack. Make sure cooling air is able to freely flow around the unit.
2. Gently lift the unit's corners and insert a support disc under each foot. The foot's elastomer ring should disappear in 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 X1'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.
8. If no CH Precision unit is to be stacked on top of the X1, 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 X1's top plate with the other unit's feet. Repeat steps 3 to 8.



**Adjustment shafts, feet and spikes**

- (1) Adjustment shafts. Insert spikes and use the provided screwdriver to adjust individual feet spikes
- (2) Feet
- (3) Adjustment spike heads (when inserted into adjustment shafts)
- (4) Adjustment spike

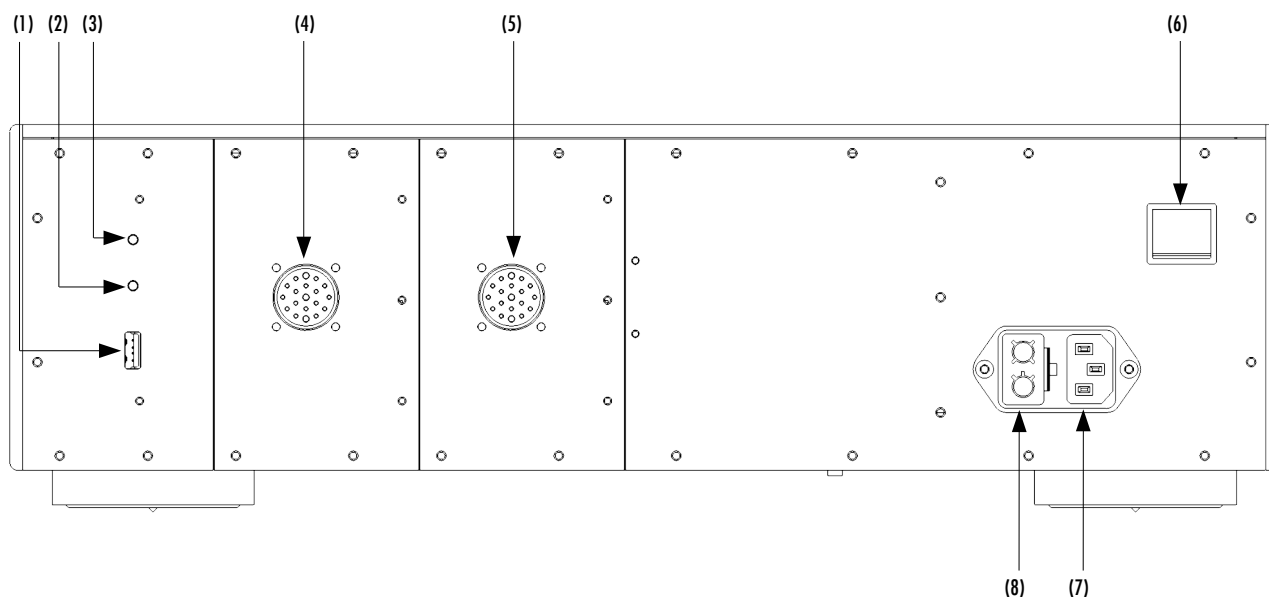
Never stack any component other than CH components on your X1. Never use the aluminum shaft covers (top covers) when another CH component is to be stacked on top of your X1.



**Shaft covers (left: stacking cover, right: top cover)**

### 3.3 Connections

This section provides information on how to connect your X1 external power supply to your system. As the X1 can be configured to power one or two CH Precision devices, it can be fitted with a single or two POWER SOURCE boards (the picture below shows an X1 with two POWER SOURCE boards).

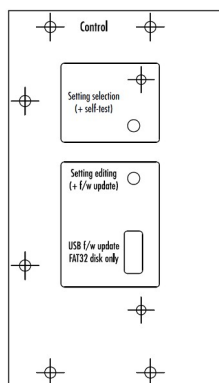


**Rear panel connections**

- (1) USB port for software upgrades.
- (2) Push-button for software upgrades and parameter value editing
- (3) Push-button for X1 self-test and parameter selection
- (4) Power Link Cable connector to power a CH precision unit, such as C1.2, D1.5, L1 or P1
- (5) Power Link Cable connector to power a CH precision unit, such as C1.2, D1.5, L1 or P1 (optional)
- (6) Power on/off switch
- (7) Power cord receptacle
- (8) Mains fuse and voltage selection

### 3.3.1 CONTROL board

The CONTROL board is factory installed into the X1. It provides a USB port for software updates and two push-buttons for configuration. The following drawing shows the layout of the back panel of the CONTROL board:



**CONTROL board back panel layout**

### 3.3.1.1 USB port

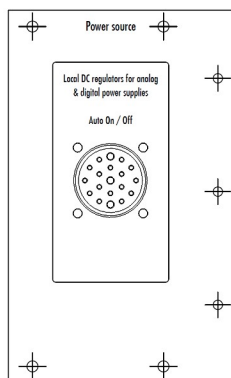
The USB port on the CONTROL board is dedicated to the firmware update of the X1 unit. Do not use it for any other purpose. For more information on unit firmware update, please refer to chapter 5 of this manual.

### 3.3.1.2 Push-buttons

Two push-buttons allow access to four functions, depending when they are pushed. Detailed information on that topic is provided in chapter 4 (Operation) of this manual.

## 3.3.2 POWER SOURCE board

As an X1 can be used to power one or two CH Precision units, it can be fitted with one or two Power source boards. Each board has its own set of discrete regulators for analog and digital voltage rails. The following drawing shows the layout of the back panel of the POWER SOURCE board:



**POWER SOURCE board back panel layout**

### 3.3.2.1 Power connector

The interface between an X1 and a CH Precision unit is handled by the Power Link Cable, plugged to the 19-poles connector at both ends.

Make sure both X1 and X1-powered unit are turned off completely (Power on/off switch in the off position) before connecting the two units together. Insert the Power Link Cable plugs and secure them by fully tightening their outer ring.

Then both units can then be switched on (Power on/off switch in the on position). They will remain in standby until the X1-powered device is taken out of standby (by pushing its inner encoder, or from its remote control).

The X1's wake up and standby operations are automatically taken care of by signals exchanged between the units through the Power Link Cable, so no user action is required on the X1 once its power switch is in the on position.





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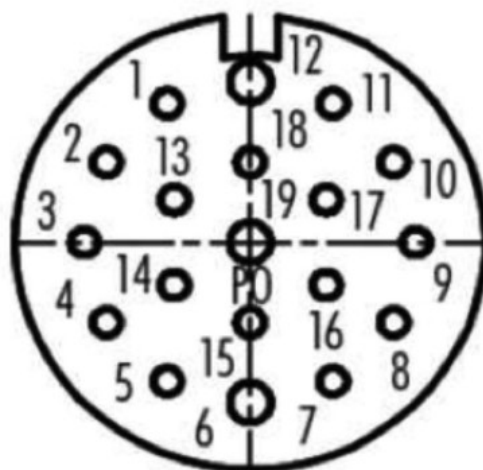
### **3.3.3 Power cord receptacle and voltage selection**

Make sure that the voltage selection is set to the correct value with respect to the AC mains voltage in your location. Connect the power cord to the power cord receptacle and plug the power plug to an AC wall socket only after all the other connections were made.

## 4 External power supply connector

The external power connector allows you to pop out the optional CH Precision X1 power supply to further enhance the performance of your D1.5 / C1.2 / L1 and/or P1. When the X1 is used, it completely replaces the internal power supply of the D1.5 / C1.2 / L1 and/or P1 power supply, minimizing noise, reducing background noise and increasing dynamic range and audio quality. With the X1 connected, the (small) standby transformer of the D1.5 / C1.2 / L1 and/or P1 remains active to ensure the wake-up functionality of the device, the power cord must therefore be left in place.

	X1 Voltage	Power Max
Pos.1	+8V Digital	20W
Pos.2	-8V Digital	20W
Pos.3	GND Digital	-
Pos.4	-8V Analog	20W
Pos.5	-19V Analog	40W
Pos.6	GND Digital	-
Pos.7	+19V Analog	40W
Pos.8	+8V Analog	20W
Pos.9	+11.7V Digital	40W
Pos.10	+5.5V Digital	55W
Pos.11	+3.4V Digital	75W
Pos.12	GND Digital	-
Pos.13	GND Digital	-
Pos.14	Command	-
Pos.15	+10.5V Analog	50W
Pos.16	Command	-
Pos.17	GND Digital	-
Pos.18	+8V Digital	20W
Pos.19	GND Analog	-

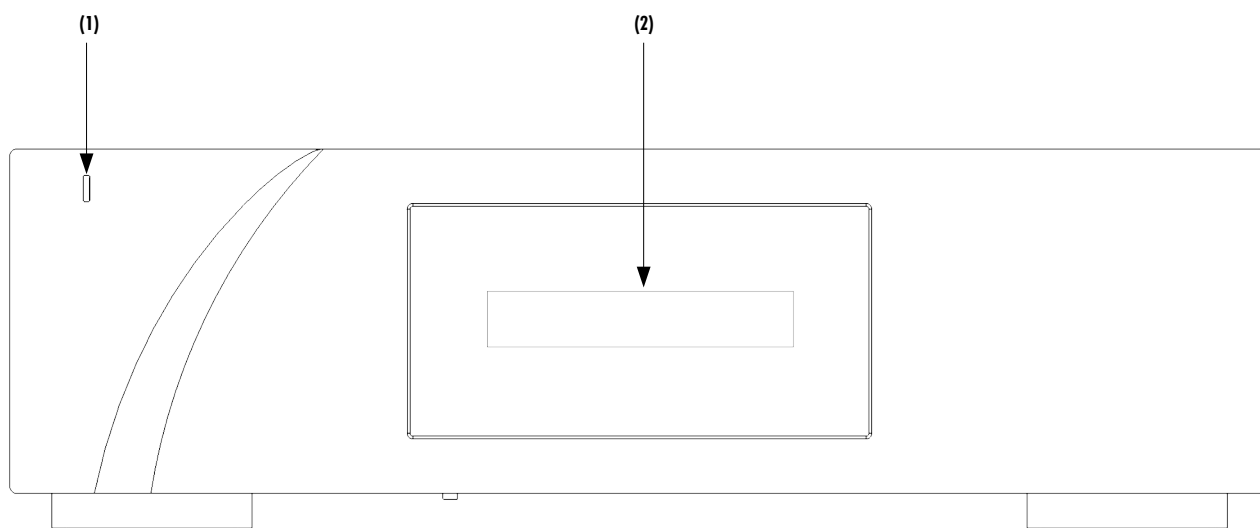


Front view

## 5 Operation

The X1 external power supply is designed to seamlessly integrate in a CH Precision setup. Once properly connected and set up, it requires no user intervention to operate.

### 5.1 Front panel



Front panel elements

(1) Standby LED

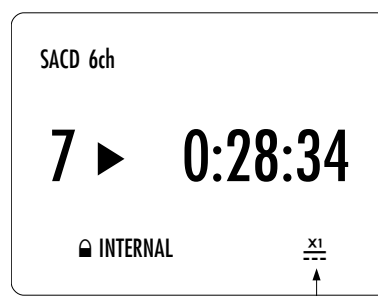
(2) Display area (PMOLED display)

The standby LED lights up when the unit is in standby, i.e. when no connected CH Precision unit is being powered. It normally turns off when the X1 is on, i.e. when at least one connected CH Precision unit is being powered. The LED can also be programmed to remain on during operation. The PMOLED display can report status. Its color and operation can be adjusted to user's taste.

When an X1 powers a CH Precision device, the powered devices report it on their AMOLED display:



C1.2 display when X1-powered



D1.5 display when X1-powered

(1) X1-powered icon

## 5.2 Configuration

The PMOLED display and the LED behavior of the X1 are customizable through two push-buttons located on the control plate at the back of the unit. Each button has two different functions: a main function and an alternate function.

- The main function is called if the button is pushed while the X1 is in standby or on (i.e. powering a CH unit).
- The alternate function is called if the button is kept pushed while X1's main power switch is flipped from OFF to ON.

Function	Button	Description
Main	1	Setting selection (scroll across all settings, displaying their value)
	2	Setting editing (scroll across all possible value of a particular setting)
Alternate	1	Self-test (check that the X1 is working well, displays a report of all tests)
	2	Firmware update (start firmware update when a USB key with valid f/w is plugged)

### Control board push-buttons description

The table below lists all X1 settings and available values for each one:

SETTING	POSSIBLE VALUES	REMARKS
DISPLAY BRIGHTNESS	20% 40% ... 100%	Display brightness during the few seconds following a status modification
LED ON/OFF	On Off	Front LED state when the X1 is ON (i.e. powering at least one CH unit)
DISPLAY MODE	Status Off	What to display when the X1 is left idle for several seconds.
INFORMATION	Firmware version Slot left Slot Right	Displays software and hardware related information about the X1

### X1 settings

## 6 Firmware update

### 6.1 Introduction

The X1's operation is managed by a microcontroller. This type of component runs a firmware which can be updated when needed, for instance to support additional features or to correct bugs. The following sections describe how to update the firmware of your X1 unit.

### 6.2 Firmware update procedure

#### 6.2.1 Preparing the firmware image

Before doing the actual firmware update, it is necessary to prepare the firmware update image. Firmware update images are available in the form of compressed `.zip` files from our website at [www.ch-precision.com](http://www.ch-precision.com).

The following procedure shows how to prepare the firmware image:

1. Start by downloading the latest X1 firmware image from [www.ch-precision.com](http://www.ch-precision.com)
2. Prepare a blank, FAT32 formatted USB stick. Please note that some USB sticks are not properly detected by the USB interface of the X1. CH Precision recommends the use of Sandisk USB flash drives such as the one delivered with the unit.
3. Decompress the firmware image `.zip` file to the root of your USB stick

After doing so, your USB stick should contain the following file:

- `X1_XXX.mcl:` Firmware update file for X1 Micro-controller

where 'XXX' indicates the software version number.

Make sure this file is present at the root of your USB stick, and that only one version of this file is present. If multiple versions of the same unit's firmware are present at the root of the USB stick, it can not be guaranteed which one will be loaded as the new X1 firmware.

#### 6.2.2 Updating the firmware

Once the USB stick is ready with the appropriate file, you can proceed with the update of the X1 unit firmware. To do so, follow these steps:

1. Turn off all CH Precision components connected to the X1.
2. Turn the X1 off by setting the Power on/off switch to off.
3. Disconnect any CH Precision unit from the X1.



4. Prepare and insert the USB key containing the appropriate firmware image for your unit (as detailed above).
5. Keep the firmware update push-button (located next to the USB receptacle at the back of the unit) pushed while powering-up the unit (by setting the Power on/off switch to on).
6. The unit will start up in firmware update mode and will update its internal firmware with the image present on the USB stick. Do not interrupt or unplug the unit until the firmware update is finished. This typically takes about 5 seconds.
7. Once the firmware update is finished, the units goes into standby mode. You can then remove the USB stick.
8. To verify that the firmware update was successful, you can press the other push-button once. The current firmware in use will be displayed.
9. Switch off the X1 unit (Power on/off switch to off) before plugging back CH Precision component(s) to be powered by the X1 unit.

**Note:** The firmware update process can last several seconds, **do NOT interrupt it!**

If the firmware update procedure fails, try to download the latest software images from [www.ch-precision.com](http://www.ch-precision.com), use another USB stick, and rerun the firmware update procedure (don't forget to prepare the software update files and USB stick accordingly). If failure persists, contact your authorized dealer.



## 7 Troubleshooting

Error	Action
No power (Front LED off)	Check the AC power cord Check the power button at the back of the unit Check the mains fuse on the AC power cord receptacle Check the Power Link Cable Disconnect matching CH Precision components (Power Link Cable) and turn X1 back on
X1 fails to power a component	Make sure Power Link Cable is properly connected and screwed all the way in at both ends Disconnect matching CH Precision components (Power Link Cable) and run a self-test on X1 (report any displayed error to your CH Precision dealer) Make sure X1-powered components are loaded with latest firmware (C1.2 firmware should be V2.7 or newer, D1.5 firmware should be V3.1 or newer, L1 firmware should be V1.0 or newer, P1 firmware should be V1.0 or newer)
Firmware update fails	Download the latest X1 firmware from <a href="http://www.ch-precision.com">www.ch-precision.com</a> , prepare a software update image on a FAT32 formatted USB stick and run the firmware update procedure again
USB flash drive for firmware update is not detected by X1	Please try another brand of USB flash drive (e.g. Sandisk).

### Troubleshooting

If the error cannot be corrected using the information from the above table, disconnect the unit from AC wall power and from the rest of your system and contact your authorized dealer.



## 8 Specifications

General	
CH Precision compatible devices (so far)	C1.2, D1.5, L1 and P1
User control	Automatic on/standby functions remotely operated from connected device 2 push-buttons at the rear of the unit for configuration
Display	256 x 64 pixels white PMOLED
Power supply	Selectable 100V, 115V or 230V~, 50Hz to 60Hz
Power consumption (Standby mode)	< 0.5W
Power consumption (Normal operation)	40W to 80W per output (depending on powered device), 350W max
Operating conditions	Temperature: +5°C to +35°C, humidity: 5% to 85% (no condensation)
Dimensions (L x D x H)	440mm x 440mm x 120mm (main body)
Weight	25kg
Software update	USB port for firmware update
Output voltages	
Analog supplies	+/-19V DC +/-8V DC +11V DC
Digital supplies	+3.4V DC +5.5V DC +/-8V DC +12V DC
Protections	
Analog supplies	Over-voltage, under-voltage and over-current monitoring
Digital supplies	Over-voltage, under-voltage and over-current monitoring
Connections	
Back panel	19-poles M23 connector compatible with C1.2, D1.5, L1 and P1 external PSU connector
Cable	2 meter cable with 19-poles M23 connectors (male & female)

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 Manuela Federica Krebs



## 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 radio/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.

