

Fractal Block World (Xar) Game Manual

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1 The Xar Package

The program Fractal Block World allows for custom games, called *packages*. The default package that comes with the program is called Xar. That Xar package is what this manual is about.

2 Cheat Codes

2.1 The Cheat Code Password

We strongly recommend NOT using cheat codes when playing the game for the first time because it can ruin the experience. However there are times

when it makes sense to use cheat codes. One such time is when you are creating your own world.

To be able to use cheat codes, you first must enter the **cheatcode password**. When in the game, first open the console (press `~`) and then type

cheat PASSWORD

then press enter. Instead of literally typing “PASSWORD”, use the cheat code password. The password comes from math. There are clues for this password in the world, and it is a challenge to find these clues! However here it is right now: it is in the following table in row three plus one and column four minus two.

modtreefir	ilikecheese	zerosharp	woodincard
hotrodlincoln	foobarbaz	thecoremodel	godelwasright
piisprecisely3	infinityisbig	finestructure	thementleisv
pfaistrue	hodisclosetov	mousecapturing	gchistrue
stationarytower	mightymouse	berkeleycardinal	schistrue

2.2 program_startup.txt

If you are going to use cheat codes, there are probably other things you will want to configure as well.

When the program starts up, it looks in the directory `Input/Scripts` for the file “`program_startup.txt`”. If you have not created this file already, you can copy it from “`Input/Scripts/program_startup_backup.txt`”. As we update the game, we may modify `program_startup_backup.txt`, but we will never modify “`program_startup.txt`”.

In this `program_startup.txt` file, you can add the line “`cheat PASSWORD`” but with the correct cheat code password. If you do this, then everytime you start the program cheat codes will be enabled.

2.3 Engine Cheat Codes

Some cheat codes are built into the engine itself. Here are some:

- “`god`”: This will make you not take damage.
- “`shrink`”: This will cause you to shrink one time. However, “`shrinkany mode`” must be enabled.

- “grow”: This will cause you to grow one time. However, “shrinkany mode” must be enabled.
- “shrinkany”: This will toggle “shrinkany mode”. When shrinkany mode is enabled this will allow you to shrink anytime by entering the command “shrink”, and grow anytime by entering the command “grow”. With the default key bindings, pressing X will cause you to shrink (it will execute the shrink command) and pressing Z will cause you to grow.
- “noclip”: This will toggle your ability to move through walls.
- “telehome”: This will teleport you to your EMERGENCY waypoint.

2.4 Xar Cheat Codes

Here are also cheat codes defined by the Xar package. Consider for example, the command

```
game_input cheat_giveall.
```

This cheat code will refill your ammo and health. The command “game_input STR” gives the string STR to the top.game_input function in Game/top.lua in the package. Typing this command can be tedious, so you can add the following line to program_startup.txt:

```
alias iwantammo “game_input cheat_giveall”
```

Now, if you enter the command “iwantammo” into the console, it will execute the command “game_input cheat_giveall”. In fact, you may find that there are already aliases like this defined in “program_startup_backup.txt”.

Note that in the Xar package, if you run the command “game_input help”, that will print a list of everything you can pass to “game_input”.

Here is a list of some of the Xar cheat codes:

- “game_input cheat_takeall”: This will remove all your ammo and most of your health.
- “game_input cheat_giveall”: This will give you full ammo and health.
- “game_input cheat_givegold”: This will give you a lot of gold.

- “game_input cheat_giveupgrades”: Sets your upgrade levels to be somewhat high (about 100).
- “game_input cheat_giveupgrades2”: Sets your upgrades to that of someone who has played a new game for 20 hours.
- “game_input cheat_greemarkers”: Toggles whether or not it costs money to drop markers.
- “game_input cheat_topofworld”: Teleports you to the top of the world (very close to the root of the chunk tree).
- “game_input cheat_pink”: Simulates touching Pink Rings.
- “game_input cheat_blue”: Simulates touching Blue Rings.

3 Controls

3.1 Default Controls

Here are the default controls to play the game. These can be customized.

- W,A,S,D = moving forward, back, left, right
- SPACE = moving up
- LEFT SHIFT = moving down
- Q,E = twisting (if “use true up” is disabled)
- 0,1,...,9 = select weapon
- TAB = toggle rocket mode
- LEFT CTRL = brake
- T = telekinesis
- F = use
- F1, F2, F3, F4, F5 = info about the player
- BACKSPACE = take screenshot

- PRESS M = drop short marker
- HOLD M FOR 1 SECOND = drop long marker
- MOVING MOUSE = turning
- MOUSE LEFT CLICK = shoot primary
- MOUSE RIGHT CLICK = shoot secondary

When *rocket mode* is on, the player moves through the air with less drag. When the *brake* is being held down, a high amount of drag is applied. When *telekinesis* is used, all items visible to the player within a certain radius are picked up.

3.2 Use True Up

There are two camera modes you can select: use true up or do not use true up. You can toggle between the two by going to OPTIONS → PACKAGE TOP MENU → CAMERA. When use true up is enabled, the up direction of the camera is always the true up direction of the world. When this is disabled, you can be upside down and may need to press Q and E to twist yourself to be right side up again. Enabling use true up is easier, but it gives you less control if you are facing either directly up or directly down.

3.3 Customizing Controls (Key Bindings)

To customize the controls, **first you must load a game**. Then, go to OPTIONS → CONTROLS → INPUT BINDINGS → CONTROLS. In this menu, you can select an action, like MOVE_FORWARD, and then press whatever key or mouse button you want bound to it.

Note: If you want multiple keys bound to the same action, you will need to set this in OPTIONS → CONTROLS → INPUT BINDINGS → INPUT EVENTS.

The actions you can bind input events to are in two categories:

- package actions
- custom actions.

Package actions are defined by the package. The Xar package, for example, has an action named `MOVE_FORWARD`. Custom actions, on the other hand, are set by the player. You can create/modify custom actions in `OPTIONS → CONTROLS → INPUT BINDINGS → ACTIONS`. If you create a custom action, you should give it a nickname to keep track of it. Then, you can set the action's primary and secondary command.

Let's say the key `W` is bound to the action `MOVE_FORWARD`. Then when the `W` key is pressed down, the primary command of the `MOVE_FORWARD` action will be executed. When the `W` key is released, the secondary command of the `MOVE_FORWARD` action will be executed.

4 Dying, Saving, and Loading

When you die, you will respawn at your current **respawn point**. You can change your current respawn point by finding an inactive respawn point and activating it (hold down `F` while looking at it, then select "yes"). When you die, you will NOT lose any of your upgrades. You will, however, lose all armor and ammo (except plasma, which will be reset to the max amount). You also lose 30 gold.

For convenience, you can save your game at **save points** (within the world). You simply look at one and press `F`. You can also save your game at any time using the main menu.

You **load** a game by going to the main menu.

You may find yourself in a situation where you want to kill yourself in order to respawn at your respawn point. You can kill yourself at any time in the main menu by selecting `OPTIONS → PACKAGE TOP MENU → RESPAWN`.

5 Rebooting the Player

If a change is made to either the engine or the Xar package which completely invalidates your save file, you will want to *reboot the player*. You can do this by going to `OPTIONS → GAME LOADING / SAVING → REBOOT`

PLAYER. This will start you back at the starting position of the game. Your waypoints will all be removed. However, you will keep all your upgrades, gold, and trophies, which is what really matters.

6 Markers

To avoid getting lost, you can drop a marker. There are two types of markers: short (temporary) and long (permanent). A short marker stays in the world for 3 hours. A long marker stays forever. Additionally, long markers are visible from a longer distance. You can still see a long marker even when you grow one time. Also, you can leave messages to yourself in long markers by looking at them and pressing F.

Dropping a short marker costs 10 gold whereas dropping a long marker costs 20 gold. However, there are marker buying stations where you can buy *short* markers for cheaper prices. Buying a short marker like this adds it to your inventory. When you die, you lose all these (short) markers in your inventory.

You can remove a marker by shooting it enough times with your plasma weapon.

7 Shield, Health, and Armor

At the beginning of the game, the following are all zero:

- your **max health level**,
- your **health regen level**,
- your **> 100% health regen level**, and
- your **armor regen level**.

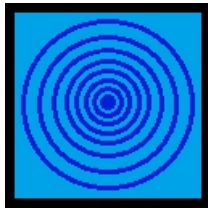
Your max health level determines your maximum health, whereas the other three determine how fast your health and armor generate. These four levels increase permanently when you get various upgrades. The max health and health regen upgrades look like white boxes with a red plus in the middle, but there are little boxes at the 8 vertices of the cube. A > 100% health regen upgrade looks like the following:



An armor regen upgrade looks like Jade Armor but with little boxes at the 8 vertices of the cube.

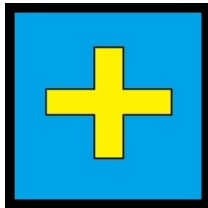
7.1 Shield

Your shield amount is shown above the following icon in your HUD (heads up display):



Your max shield amount is $25 +$ your health level.

Your shield will become fully recharged when you pick up a box that looks like this:



Also, your shield regenerates by itself. It regenerates at a rate of $1 + \frac{1}{4}X$ points per second, where X is your health regen level.

7.2 Health

Your max shield amount times 4 is called your **basic max health amount**. Hence, your basic max health amount is $4(25 + X) = 100 + 4X$ where X is your health level.

Said another way, every time you increase your health level by 1, your max shield amount increases by 1 and your basic max health amount increases by 4. Thus, you are able to stand 5 more points of damage when you have (normal) max shield and health.

Let B = your basic max health amount. Your health regenerates half as quickly as your shield. In other words, your health regenerates $\frac{1}{2} + \frac{1}{8}X$ points per second, where X is your health regen level. Putting this together with your shield, every time you increase your health regen level by 1, you increase the damage you can withstand *per second* by an additional $\frac{3}{8}$ -th of a point.

At the beginning of the game, your health will regenerate until it reaches B , but no further (later in the game you can get RejuvenX upgrades which cause your health to regenerate up to $2B$). You can, however, pick up items to temporarily cause your health to go beyond B . Once your health is more than $2B$, you will lose 1 health per second. Your health can never be more than $5B$.

Picking up a box that looks like this



will increase your health by $\frac{1}{10}B$, but not past $2B$. Picking up a box that looks like this



will increase your health by $\frac{1}{4}B$, but not past B . Picking up a box that looks like this



will bring your health up to B (if it is below this already). Picking up a box that looks like this



will bring your health up to $2B$ (if it is below this already). Finally, picking up a box that looks like this (the “megahealth”)

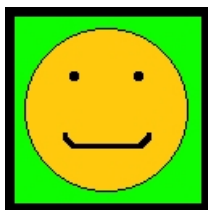


will increase your health by B (but not past $5B$).

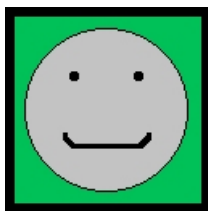
7.3 Armor

Let B = your basic max health amount (see the previous section on Health). Your max armor amount is $10B$. Armor does not regenerate (unless you have obtained a very special upgrade to increase your armor regen level).

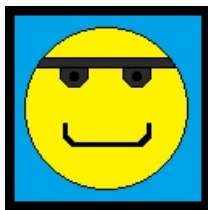
Picking up the bronze armor



will bring your armor up to B (if it is below this already). Picking up the silver armor



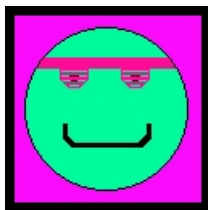
will bring your armor up to $\frac{3}{2}B$ (if it is below this already). Picking up the gold armor



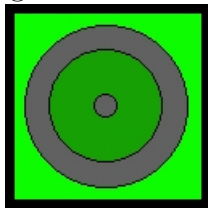
will bring your armor up to $2B$ (if it is below this already). Picking up the ivory armor



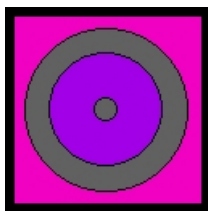
will bring your armor up to $6B$ (if it is below this already). Picking up the jade armor (oh yeah)



will bring your armor up to $10B$ (if it is below this already). The jade armor is sick. Picking up the following



will increase your armor by $\frac{1}{20}B$, but not past $2B$. Picking up the following



will increase your armor by $\frac{1}{10}B$, but not past your max armor level $10B$.

There are also 2 items which give you both health and armor at the same time. The following



will bring both your health and armor amount up to B . The following



will bring both your health to $2B$ and your armor to B . Finally,



will bring both your health and armor amount up to $2B$.

7.4 Being Dealt Damage

When you are dealt damage, it is dealt to your shield until your shield is completely empty. At that point, damage is done to your health and armor.

When damage is done to your health and armor, if your health is less than your basic max health amount, then 75% of the damage is dealt to your armor and 25% is dealt to your health. On the other hand, if your health is greater than your basic max health amount, then 0% of the damage is dealt

to your armor and 100% is dealt to your health.

8 Other Entities

8.1 Gold

You can have a maximum of one million gold. When you die, you lose 30 gold.

You can pick up gold within the game. A box that holds 1 gold looks like this:



There are similar boxes for picking up larger amounts of gold.

8.2 Sell station

Another way to get gold is to sell items at a sell station. Sell stations look like this:

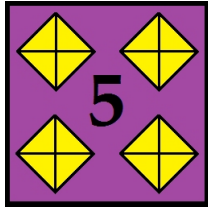


The amount of gold you get for ammo etc depends randomly on the sell station. Red ones (common) give the worst prices, yellow ones (scarse) give you better prices, and green ones (rare) give you the best prices.

Note: at a sell station you can also get gold by selling the health you have above $2B$.

8.3 Marker Buying Station

There are various things you can do with your gold. One thing is to buy markers at a station that looks like this:



At a station that looks like this, you can buy one (short) marker for 5 gold. There are other stations for buying a marker for 4, 3, 2, or 1 gold. See the section about markers for more information.

8.4 Buy station

At a **buy station**, you can use gold to buy ammo. A buy station looks like this:



Here are the options at a buy station:

- Buy 20 cannon ammo for 100 gold.
- Buy 100 laser ammo for 100 gold.
- Buy 50 rocket ammo for 100 gold.
- Buy 1000 homing ammo for 100 gold.
- Buy 100 minigun ammo for 100 gold.
- Buy 20 railgun ammo for 100 gold.
- Buy 1 EMP ammo for 100 gold.
- 200% health for 100 gold.
- 100% armor for 100 gold.
- 150% armor for 150 gold.
- 200% armor for 200 gold.

The health and armor options bring your health or armor up to the specified amount.

Picking up ammo in the world is generally more desirable than buying it at a buy station.

8.5 Black Market

At a **black market** you can buy ammo at a cheaper price. A black market looks like this:

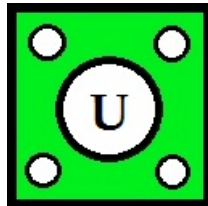


Here are the options at a black market:

- Buy 50 railgun ammo for 100 gold.
- Buy 2 EMP ammo for 100 gold.
- Buy 2 nuke ammo for 100 gold.

8.6 Upgrade Station

At an upgrade station you can pay gold to get upgrades. An upgrade station looks like this:



Here are the options at an upgrade station:

- plasma damage upgrade for 100 gold.
- cannon damage upgrade for 100 gold.
- laser damage upgrade for 100 gold.

- rocket damage upgrade for 100 gold.
- railgun damage upgrade for 200 gold.
- EMP damage upgrade for 100 gold.
- nuke damage upgrade for 200 gold.
- dark hole damage upgrade for 300 gold.
- health capacity upgrade for 200 gold.
- health regen upgrade for 100 gold.

8.7 Damage Multiplier

Picking up this upgrade will multiply the damage you do by a factor of 5 for some number of seconds. If you pick of multiple of these, the length of the effect will *stack*.



8.8 Experience Points Multiplier

Picking up this upgrade will multiply the amount of experience you get from killing monsters by a factor of 5 for some number of seconds. If you pick of multiple of these, the length of the effect will *stack*.



9 Weapons

You have 10 weapons. Each weapon has its own type of ammo. Your plasma ammo regenerates over time, but no other ammo does this. At the beginning of the game, you can only use your plasma weapon. You can use a weapon as soon as you get any upgrade for it.

9.1 Plasma Gun

Your plasma ammo regenerates. At the beginning of the game, it regenerates at a rate of $\frac{1}{2}$ ammo per second. This increases by $\frac{1}{8}$ for each plasma gun **regeneration** upgrade you get.

The max ammo is 40, but this increases by 10 for each plasma gun **ammo capacity** upgrade you get.

The **Basic High DPA**, **Rapid Fire**, and **Hyper Rapid Fire** shoots $(4 + N)$ times per second, where N is the number of plasma gun **fire rate** upgrades you have. The **Plasma Shotgun** and **Lightning Rifle** both shoot 1.5 times per second. You can have at most 12 of these upgrades (so you can shoot at most 16 times per second). These fire rate upgrades are **very rare**.

The Basic High DPA shots travel at a rate of $(4 + N)$ blocks per second, where N is the number of plasma gun **speed** upgrades you have. Rapid Fire and Plasma Shotgun shots travel twice as fast. Hyper Rapid Fire shots travel at three times the normal speed. The Lightning Rifle shots travel one million blocks per second. You can have at most 46 of these speed upgrades (so a primary plasma shot can travel at most 50 blocks per second, and a secondary shot can travel at most 100 blocks per second).

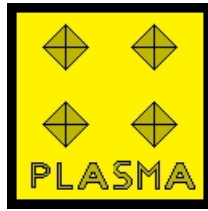
The Basic High DPA fire shoots a shot that does $(4 + N)$ damage, where N is the number of plasma gun **damage** upgrades you have. The Rapid Fire shoots 8 shots at once, but each shot does only $\frac{1}{2}$ of the damage of an ordinary shot. Thus, the Rapid Fire does 4 times the DPS as the primary fire, but it is wasteful in terms of ammo.

The Plasma Shotgun has a reasonable DPS and has the same DPA as Basic High DPA.

Hyper Rapid Fire mode has a very high DPS but a very low DPA.

The Lightning Rifle has a low DPS and DPA, but as mentioned before the shoots travel very fast.

An ammo box for the plasma gun looks like this:



This will refill your plasma ammo to full capacity.

Plasma only interacts with enemies on the same level of detail as yourself.

9.2 Cannon

The max ammo is 100, but this increases by 5 for each cannon **ammo capacity** upgrade you get. The primary and secondary both use 1 ammo.

The gun shoots $(1 + \frac{1}{4}N)$ times per second, where N is the number of cannon **fire rate** upgrades you have. You can have at most 12 of these upgrades (so you can shoot at most 4 times per second).

The primary fire launches $(4 + N)$ balls, where N is the number of cannon **num** upgrades you have. You can have at most 8 of these upgrades (so you can shoot at most 12 balls at once). The primary fire will shoot each ball in a direction relatively close to the direction the player is looking. The secondary fire, on the other hand, only launches 1 ball.

A primary fire ball travels $(8 + 2N)$ blocks per second, where N is the number of cannon **speed** upgrades you have. The secondary fire ball travels twice as fast as a primary ball. You can have at most 11 of these speed upgrades (so a primary ball can travel at most 30 blocks per second, and a secondary ball can travel at most 60 blocks per second).

A primary fire ball does $(2 + N)$ damage, where N is the number of cannon **damage** upgrades you have. A secondary ball will do $\frac{1}{2}$ the amount of damage as the total damage of all primary fire balls.

The secondary fire also has a chaining effect. If the cannon ball kills an enemy, it will target the next closest enemy and will fly towards it. Every time the cannon ball kills an enemy, the damage that that ball does is reduced by the amount of damage it just did. So if the ball does 100 damage but kills an enemy that has a total of 20 health, then the ball will continue but now is able to deal 80 damage.

An ammo box for the cannon gun looks like this:



A small ammo box holds 5 ammo, and a large ammo box holds 25 ammo. A huge ammo box usually has 200 ammo.

9.3 Laser Gun

The max ammo is 32, but this increases by 8 for each laser gun **ammo capacity** upgrade you get. These upgrades are **rare**.

The gun shoots $(2 + \frac{1}{2}N)$ times per second, where N is the number of laser gun **fire rate** upgrades you have. You can have at most 8 of these upgrades (so you can shoot at most 6 times per second). The laser gun shot is infinitely fast.

The primary fire does F_1 times F_2 damage. F_1 is the usual damage factor, and it is equal to $(8 + 2N)$, where N is the number of laser gun **damage** upgrades you have. On the other hand, F_2 is your super damage factor. At the beginning of the game it is 1, and it increases by 1 for each laser gun **super damage** upgrade.

The primary fire has two special effects. First, shooting it will automatically **recharge your shield**. Second, when you shoot an enemy with the primary fire of the laser it will **freeze the enemy** for $2 + \frac{1}{2}N$ seconds, where N is the number of laser gun **freeze time** upgrades you have. You can have a total of 36 of these upgrades (so you can freeze an enemy for a maximum of 20 seconds). When an enemy is frozen it cannot attack you. Some enemies are immune to this freeze effect.

The secondary fire shoots 8 shots at once, where each shot does 4 times the amount of damage as usual, but **you will be dealt 50 damage**. For example, when you first get the laser gun in the game and have at least 8 ammo, the secondary fire will deal 256 damage to your enemy but will deal 100 damage to you. Also, if the secondary successfully kills a monster, then this will launch primary laser beams at all nearby monsters of the same size.

An ammo box for the laser gun looks like this:



A small ammo box holds 8 ammo, and a large ammo box holds 32 ammo.

The laser can damage enemies that are on two levels of detail coarser than the player.

9.4 Rocket Launcher

The max ammo is 20, but this increases by 4 for each rocket launcher **ammo capacity** upgrade you get.

The weapon shoots $(1 + \frac{1}{4}N)$ times per second, where N is the number of rocket launcher **fire rate** upgrades you have. You can have at most 16 of these upgrades (so you can shoot at most 5 times per second).

A **Basic Rocket** travels $(24 + 2N)$ blocks per second, where N is the number of rocket launcher **speed** upgrades you have. There is no limit to this upgrade. **A secondary rocket travels $\frac{1}{8}$ as fast.**

A direct hit by a Basic Rocket will deal an enemy $(64 + 16N)$ damage, where N is the number of rocket launcher **damage** upgrades you have.

When a Basic Rocket explodes and an enemy is within $(4 + N)$ blocks of the point of explosion, where N is the number of rocket launcher **radius** upgrades you have, then the enemy will be dealt $\frac{1}{2}$ as much damage as a direct hit. An enemy that gets a direct hit is not effected by this. You can have at most 28 rocket launcher radius upgrades (so the explosion radius can be at most 32).

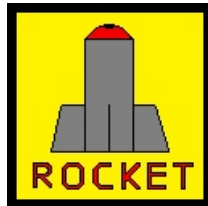
A **High Velocity Rocket** does half the damage per rocket as Basic Rockets, but 3 rockets are fired at once. This causes it to have twice the DPS as Basic Rockets, but only $\frac{2}{3}$ the DPA as Basic Rockets. The velocity is 8 times the speed as Basic Rockets.

A **Big Radius Rocket** has double the damage as the Basic Rocket, but it uses two ammo per shot. So, it has the same DPA (damager per ammo) as Basic Rockets but it has double the DPS as Basic Rockets. The rocket moves at $\frac{1}{4}$ the speed as Basic Rockets and the explosion radius is doubled.

A **Kinetic Rocket** does 4 times the damage as a Basic Rocket, moves at $\frac{1}{8}$ the speed, and does not explode.

A **Progressive Rocket** does 6 times the damage as a Basic Rocket, moves at $\frac{1}{64}$ the speed, and does not explode.

An ammo box for the rocket launcher looks like this:



A small ammo box holds 5 ammo, and a large ammo box holds 20 ammo.

A rocket can damage enemies that are coarser than the player.

9.5 Homing Rocket Launcher

The max ammo is 200, but this increases by 10 for each homing rocket launcher **ammo capacity** upgrade you get.

The primary shoots $(3 + \frac{1}{8}N)$ times per second, where N is the number of rocket launcher **fire rate** upgrades you have. You can have at most 56 of these upgrades (so you can shoot at most 10 times per second). The secondary shoots half as many times per second.

A rocket travels $(4 + N)$ blocks per second, where N is the number of homing rocket launcher **speed** upgrades you have. You can have at most 46 of these upgrades (so a rocket can travel at most 50 blocks per second).

Primary fire launches a single rocket in the direction that the player is looking. A primary rocket will deal $(32 + 8N)$ damage upon impact, where N is the number of homing rocket launcher **damage** upgrades you have. Secondary fire launches 20 rockets but only costs 10 ammo. However each rocket only does 1/2 the damage as a primary rocket.

Both a primary and a secondary rocket will lock onto a target. Once locked on, a rocket will move towards its target until it makes a hit.

An ammo box for the homing rocket launcher looks like this:



A small ammo box holds 10 ammo, and a large ammo box holds 50 ammo. A huge ammo box usually has 2000 ammo.

A homing rocket only interacts with enemies on the same level of detail as yourself.

9.6 Minigun

The max ammo is 48, but this increases by 12 for each minigun **ammo capacity** upgrade you get.

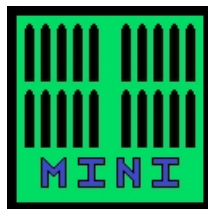
The primary fire shoots $(4 + N)$ times per second, where N is the number of minigun **fire rate** upgrades you have. You can have at most 26 of these upgrades (so the primary can shoot at most 30 times per second). The secondary fire shoots 4 times per second.

The primary fire shots travel 1000 blocks per second, but the secondary shots travel $(16 + 4N)$ blocks per second, where N is the number of minigun **speed** upgrades you have. You can have at most 100 of these upgrades (so a secondary shot can travel at most 416 blocks per second).

The primary fire does F_1 times F_2 damage. F_1 is the normal damage factor and it equals $(32 + 8N)$, where N is the number of minigun **damage** upgrades you have. On the other hand, F_2 is the super damage factor. It is originally 1, but increases by 1 for each minigun **super damage** upgrade you get.

The secondary fire does not deal any damage upon impact, but it delivers a poison effect. The poison effect lasts 10 seconds and deals as much damage as 20 primary shots. That is, the secondary does 20 times as much damage per ammo than the primary! If you shoot an enemy multiple times with the secondary fire, this will increase the poison length accordingly, however the damage per second will be the same.

An ammo box for the minigun looks like this:



A small ammo box holds 12 ammo, and a large ammo box holds 50 ammo. A huge ammo box usually has 1000 ammo.

The primary and secondary fire of the minigun can damage enemies that are 1 level coarser than the player.

9.7 Railgun

The max ammo is 48, but this increases by 12 for each railgun **ammo capacity** upgrade you get.

The gun shoots $(\frac{1}{2} + \frac{1}{4}N)$ times per second, where N is the number of railgun **fire rate** upgrades you have. You can have at most 14 of these upgrades (so you can shoot at most 4 times per second).

A primary shot travels at 10,000 blocks per second. A secondary shot travels at 1,000,000 blocks per second.

The primary fire does $(128 + 32N)$ damage, where N is the number of railgun **damage** upgrades you have. The secondary fire does only $\frac{1}{2}$ the damage as the primary, but $\frac{1}{4}$ of the damage *dealt* gets added to your health (but this will not increase your health beyond $2B$).

An ammo box for the railgun looks like this:



A small ammo box holds 10 ammo, and a large ammo box holds 50 ammo.

The railgun can damage enemies that are coarser than the player.

9.8 EMP

The max ammo is 2, but this increases by 1 for each EMP **ammo capacity** upgrade you get.

The primary and secondary both shoot 1 time per second.

When a shot is fired, all enemies within a sphere centered at the player become temporarily stunned and are dealt damage. The sphere radius is $(16 + 4N)$, where N is the number of EMP **radius** upgrades.

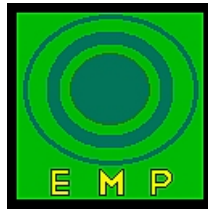
When the EMP is detonated, an enemy is stunned for $(4 + N)$ seconds, where N is the number of EMP **num** upgrades you have. When an enemy is

stunned, it cannot attack you. Some enemies are immune to the stun effect of the EMP.

When the primary is used, no damage is dealt. However, when the secondary fire of the EMP is used, enemies are dealt $(32 + 8N)$ damage, where N is the number of EMP **damage** upgrades you have. Note: only enemies that are in the part of the world that has been loaded will be damaged. Also when using the secondary fire, **you will be dealt 100 damage**.

The EMP only affects enemies on the same level as you.

An ammo box for the EMP looks like this:



There is only one size ammo box, and it holds 1 ammo.

9.9 Nuke

The max ammo is 1, but this increases by 1 for each nuke **ammo capacity** upgrade you get.

The primary and secondary both shoot 1 time per second.

A primary nuke travels $(12 + N)$ blocks per second, where N is the number of nuke **speed** upgrades you have.

When a nuke is launched using the primary fire and it explodes, it deals $(4000 + 1000N)$ damage to all enemies within a $(16 + 4M)$ radius, where N is the number of nuke **damage** upgrades you have, and M is the number of nuke **radius** upgrades you have. When the secondary fire is used, the nuke travels twice as fast and has double the explosion radius, but it only deals half the damage.

An ammo box for the nuke looks like this:



There is only one size ammo box, and it holds 1 ammo.

A nuke can damage enemies that are coarser than the player.

9.10 Dark Hole

The max dark hole ammo is 1, but this is increased by 1 for each dark hole **ammo capacity** upgrade you get.

The secondary can be used 4 times per second. The secondary fire does not launch anything but will cause you to gain 1 additional ammo. However, **you will be dealt 100 damage.**

A dark hole travels $(32 + 8N)$ blocks per second, where N is the number of dark hole **speed** upgrades you have.

To fire a primary shot, you should hold down the fire button and release when you actually want to fire. The longer you hold it down, the more damage the shot deals. Each second you hold down the fire button will increase the damage, however this will deal you damage.

Here is how the primary damage works exactly: Let B be the “base damage amount”. B is equal to $(400 + 100N)$, where N is the number of dark hole **damage** upgrades you have. Let D be the “adjusted damage”. If you just tap the fire button and release, this will do $D = B$ damage. If you hold down fire for one second, it will do $D = B + 2B$ damage but you will be dealt 100 damage. If you hold down fire for two seconds, it will do $D = B + 2B + 5B$ damage but for that second second you will be dealt 200 damage. If you hold down the fire for three seconds, it will do $D = B + 2B + 5B + 10B$ damage, but for that third second you will be dealt 300 damage. The pattern continues like: $+15B$, $+20B$, $+25B$, etc.

A direct hit to a monster deals $2D$ damage. The next closest monster is dealt $D/2$ damage. The next closest monster is dealt $D/3$ damage. The next closest monster is dealt $D/4$ damage. Etc.

A dark hole **ONLY** damages enemies on a coarser level of detail.

An ammo box for the dark hole gun looks like this:



This will refill your dark hole ammo to full capacity.

9.11 Beyond Max Upgrade Amount

For certain weapons, you can only get so many upgrades of a certain type. For example, for your plasma weapon, you can only get a maximum of 46 upgrades for your projectile speed attribute. When you have this max projectile speed amount and then get another projectile speed upgrade, then you will get a plasma max ammo upgrades with a 33% probability, you will get a plasma ammo regeneration upgrade with a 33% probability, and you will get a plasma damage upgrade with a 33% probability. All this information is recorded in the following table:

- Plasma fire rate:
 - 33% Plasma max ammo
 - 33% Plasma ammo regeneration
 - 33% Plasma damage
- Plasma projectile speed:
 - 33% Plasma max ammo
 - 33% Plasma ammo regeneration
 - 33% Plasma damage
- Cannon fire rate:
 - 50% Cannon max ammo
 - 50% Cannon damage
- Cannon projectile speed:
 - 50% Cannon max ammo
 - 50% Cannon damage
- Cannon num shots:
 - 50% Cannon max ammo
 - 50% Cannon damage

- Laser fire rate:
 - 66% Laser damage
 - 33% Laser max ammo
- Rocket fire rate:
 - 33% Rocket max ammo
 - 33% Rocket damage
 - 33% Projectile speed
- Rocket radius:
 - 33% Rocket max ammo
 - 33% Rocket damage
 - 33% Projectile speed
- Homing rocket fire rate:
 - 50% Homing rocket max ammo
 - 50% Homing rocket damage
- Homing rocket projectile speed:
 - 50% Homing rocket max ammo
 - 50% Homing rocket damage
- Minigun fire rate:
 - 50% Minigun max ammo
 - 50% Minigun damage
- Minigun projectile speed:
 - 100% Minigun damage
- Railgun fire rate:
 - 66% Railgun damage
 - 33% Railgun max ammo

10 Experience And Leveling Up

You get experience points (XP) by killing monsters. The purpose of XP is to level up. The maximum level you can level up to is 500. You can monitor how close you are to the next level by the vertical bar on the right hand side of your screen. You can also press F3 for more info about your XP.

Every time you level up, you get the same set of upgrades:

- One damage upgrade for each of your 10 weapons.
- One max health upgrade.
- One health regeneration upgrade.

Every 10th level, in addition to your usual leveling up upgrades you will get bonus upgrades (milestone upgrades). You can see the next few milestone upgrades when you press F3). You claim your milestone upgrades by pressing F3 then pressing enter. Here are the milestone upgrades:

- Level 10: 20 Health Regen Upgrades
- Level 20: 20 Health Max Upgrades
- Level 30: Laser Max Ammo Upgrade
- Level 40: 20 Cannon Damage + 8 Cannon Num Shots Upgrades
- Level 50: Plasma Fire Rate Upgrade
- Level 60: 10 Above 100% Health Regen Upgrades
- Level 70: Rocket Fire Rate Upgrade
- Level 80: Laser Super Damage Upgrade
- Level 90: Armor Regen Upgrade
- Level 100: Minigun Super Damage Upgrade
- Level 110: 20 Rail Damage Upgrades
- Level 120: Laser Super Damage Upgrade
- Level 130: 5 EMP Radius + 5 EMP Free Time Upgrades

- Level 140: 20 Nuke Projectile Speed Upgrades
- Level 150: Laser Max Ammo Upgrade
- Level 160: Laser Super Damage Upgrade
- Level 170: Armor Regen Upgrade
- Level 180: Rocket Fire Rate Upgrade
- Level 190: Plasma Fire Rate Upgrade
- Level 200: Minigun Super Damage + Laser Super Damage Upgrade
- Level 210: 20 Rocket Damage Upgrades
- Level 220: 20 Laser Damage Upgrades
- Level 230: 20 Homing Max Ammo Upgrades
- Level 240: Laser Super Damage Upgrade
- Level 250: Laser Max Ammo Upgrades
- Level 260: 20 Minigun Damage Upgrades
- Level 270: Rocket Fire Rate Upgrade
- Level 280: Laser Super Damage Upgrade
- Level 290: Plasma Fire Rate Upgrade
- Level 300: Minigun Super Damage Upgrade
- Level 310: Armor Regen Upgrade
- Level 320: Laser Super Damage Upgrade
- Level 330: 20 Nuke Damage Upgrades
- Level 340: 20 Dark Hole Damage Upgrades
- Level 350: Laser Max Ammo Upgrade
- Level 360: Laser Super Damage Upgrade

- Level 370: 20 Cannon Damage Upgrades
- Level 380: 20 Rocket Damage Upgrades
- Level 390: 20 Homing Rocket Damage Upgrades
- Level 400: Minigun Super Damage + Laser Super Damage Upgrades
- Level 410: 5 EMP Radius + 5 EMP Freeze Time Upgrades
- Level 420: 20 Homing Max Ammo Upgrades
- Level 430: Armor Regen Upgrade
- Level 440: Laser Super Damage Upgrade
- Level 450: Laser Max Ammo Upgrade
- Level 460: Rocket Fire Rate Upgrade
- Level 470: Plasma Fire Rate Upgrade
- Level 480: Laser Super Damage Upgrade
- Level 490: 20 EMP Damage Upgrades
- Level 500: Minigun Super Damage Upgrade

Again, level 500 is the max level for your player.