CRHI Standards Track Publication 100-00A
Revision 0

Standardization for the Production of Rocket Fuel

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Applicable to modpack(s): Direwolf20 1.12 v2.8.0

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Subsidiary of Capital Region Heavy Industry Corp.

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Rocket Fuel is a renewable, high energy density liquid fuel provided by the Ender IO mod. Rocket Fuel is used as fuel in some liquid burning generators such as the Combustion Generator from Ender IO, and the Gas Turbine Generator from Advanced Generators.

The production of Rocket Fuel is done in two primary stages, which is defined as follows: A set of Vats (Ender IO) take in Water, Sugar, and Potatoes to produce Hootch (alcohol). Hootch is then pumped into another set of Vats along with Redstone and Gunpowder, which then produce Rocket Fuel, as shown in Figure 1-1.

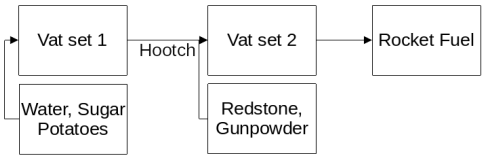


Figure 1-1. General Rocket Fuel production process.

0. Requirements Notation

The key words "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in [RFC2119].

1. Production Design Overview

There are a total of twenty two (22) steps in the production of Rocket Fuel. These steps can be as simple as gathering Cobblestone, or as complex as a fully automated mob farm, some steps require specialized systems to ensure continuous operation, while others require multiple materials from previous steps. This amount of recursiveness applies a certain degree of complexity to the whole process.

Apart from the production process itself, one must decide how each step shares material with another step. Should steps which directly relate to each other be grouped together (e.g., a step which produces Cobblestone is directly connected (over some medium) to a step which pulverizes Cobblestone into Gravel), should all steps be connected by the same medium, or should all steps be separated somehow. These are common questions one may ask themselves when building each step. As an example, one might build something similar to what is depicted in Figure 1-2 and Figure 1-3.

Figure 1-2. An example of a Rocket Fuel production system one might build.

Figure 1-3. Various Ender IO conduits makeup the transport system.

While there is nothing wrong with the setup depicted above, it is not suited to expand any further. The reason for this is the transport system depicted in Figure 1-3 (the various Ender IO conduits) requires many different item/fluid filters to properly function, and requires a unique configuration for each item/fluid conduit connection. Complexity would increase exponentially when expanding this system. This level of complexity necessitates the need for a common, standardized

configuration for the entirety of the production process. What follows is a high-level description that standard.

The rest of this document refers to a production step as a 'production system'. A production system is specialized for a specific step of the production process, and consists of one or several types of machines and an Applied Energistics 2 (AE) subnetwork. Each production system is isolated from one another, in that machines from one production system do not physically touch machines in another production system, nor are machines in one production system capable of transferring/receiving material directly to/from machines in another production system, over any type of transport medium. Instead all material transport happens through the AE transport network, see Section 2.

This document will not specify the specific number of machines used in each stage of production. This is done to give the implementer freedom to choose the appropriate number of machines for their specific situation.

1.1. Operating States of Production Systems

Operating States describe the modes of operation common to the production systems defined within this document. Only one Operating State may be used to describe the operation of a production system at any point in time. Production systems can change Operating States at anytime due to (1) human/automated action, or (2) adventitiously. Operating States apply a reason to why a production system is behaving in a certain manner, at a particular point in time. Operating States do not define a physical or electronic system, nor does it enforce any requirements on production systems (or any other type of system) defined within this document.

The following seven Operating States are:

- ACTIVE - The production system is currently processing material.
- INACTIVE - The production system is configured and ready for use, however it is currently not being supplied power.
- STALL - The production system cannot meet the supply demands of other production systems.
- REDUCED - The production system, as an attempt to avoid being put into the STALL Operation State, has partially or entirely disabled one or more of its subsystems (while not negatively effecting its ability to process material). The production system will continue to process material during this time.
- STANDBY - The production system has reached maximum storage capacity, system activity will resume when required.
- MAINTENANCE - A physical/logical reconfiguration of the production system is taking place, production may be halted entirely or degraded during this time.
- DESTROYED/DAMAGED - Production system has been rendered inoperable or production is severely degraded due to hostile action (e.g., griefing).

1.2. Expectations for a Defined Production Stage

1.2.1. Preceding Description

Each stage of the production process will have a dedicated section, the section will be titled with the end product(s) of that production stage. The first sentence will state the sequence of the production stage (ex: 'The first stage of the production process involves producing Pulverized Charcoal'). Next, an ordered list is provided with all the involved processes ordered from first-to-last. Then, an alphabetically-ordered list provides which other stages receive the product(s) produced by this production stage, each stage is named the same as its sub-section. Lastly, another alphabetically-ordered list provides all the involved machinery during this production stage, along with the mod each machine is from.

1.2.2. The Description Section

A sub-section will follow titled 'Description', this section will describe the systems/methods used in the production stage.

1.2.3. The Operating State Advisory Section

If required, following the Description section a sub-section titled 'Operating State Advisory' may appear. This section is used for production systems which modify some aspect of their physical/logical behavior when put into different Operating States via human/automated action.

The purpose of the Operating State Advisory section is to: (1) address the specific actions the production system will take when put into different Operating States, and (2) to help identify the

current Operating State of the production system.

The reason behind requiring this section for production systems which are able to change their Operating State through human/automated means, is because production systems which are capable of doing so, do so for a specific purpose and thus will exhibit unique behavior when put into different Operating States (e.g., such as an automated system disabling certain machines when the buffer chest becomes full). As such, that unique behavior must be clearly defined.

The Operating State Advisory section will contain an alphabetically-ordered list of one or more Operation States of concern. Each listed Operation State will specify the specific systems that are affected, and their modified behavior.

Lastly, Operating States that can appear as part of the Operating State Advisory are: (1) REDUCED, and (2) STANDBY. These two Operating States (aside from the ACTIVE Operating State) are the only ones that can be controlled using human/automated action (however production systems may enter these states adventitiously). As the ACTIVE Operation State is the normal, base-line of production systems, there is no need to include it into the Operating State Advisory. Only when the production system can change Operation States via human/automated action, and changing the Operation State immediately effects some aspect of the production system (e.g., enabling/disabling machinery) is an Operating State Advisory provided for that production system.

1.2.4. The Flow Charts Section

Following the Description section, or Operating State Advisory section (if present), another subsection titled 'Flow Charts' will provide one or more flow charts which describe the logical layout of the production stage.

1.2.5. The Setup Photos Section

Lastly, a sub-section titled 'Setup Photos' will provide in-game pictures relevant to the setup.

1.3. Common Energy and Transport Systems

1.3.1. Forge Energy

Unless stated otherwise, the energy system used by all machinery in this document (excluding the AE transport/production networks) is Forge Energy (FE), Micro Infinity (μI) from Ender IO is also Forge Energy.

1.3.2. Ender IO Conduits

The common transport system when connecting to machines, buffer chests/buffer drums are the various conduits provided by Ender IO. The four (4) types of conduits used are: Item Conduits, Ender Fluid Conduits, Ender Energy Conduits, and Redstone Conduits. Ender IO conduits are used because of their superior transport and configuration capabilities when compared to other types of transport systems.

1.4. Industrial Monitoring System

The goal of the following subsections is to outline the requirements for an Industrial Monitoring System (IMS). The purpose is to give readers a clear picture on the requirements of an IMS when in context to the Rocket Fuel production process. It however does not define a strict protocol or standard, and is provided purely for the consideration of the reader, who may implement what is described at their discretion.

1.4.1. Overview of the Industrial Monitoring System

The overall purpose of the IMS is to gather and display data about the various AE networks used throughout the production process.

The three (3) fundamental design characteristics of this Industrial Monitoring System are as follows:

- The IMS is constructed purely of OpenComputers: computers, cables, components, etc...
- Only Applied Energistics 2 networks are being monitored, data does not come from any other mod.
- The IMS is used solely for monitoring; the various site/facility systems cannot be controlled by the IMS.

An Adapter from OpenComputers is used to interface with each AE network, as defined in Section 2.4.

1.4.2. Telemetry Data to Collect

When in context to the Rocket Fuel production process, the following data is of concern:

- The Universally Unique Identifier (UUID) of the ME Controller.
- The average power usage of the AE network, in AE units of energy.

- The idle power usage of the AE network, in AE units of energy.
- The average power usage of the machines on the AE network, in FE units of energy.
- The type and quantity of item(s) stored within the AE network.
- The type and quantity of fluid(s) stored within the AE network.

To get the amount of FE used by machines on an AE network, use the following formula:

$$\left(\frac{(avgAEPwrUsage - idleAEPwrUsage)}{0.05}\right)\times 2$$

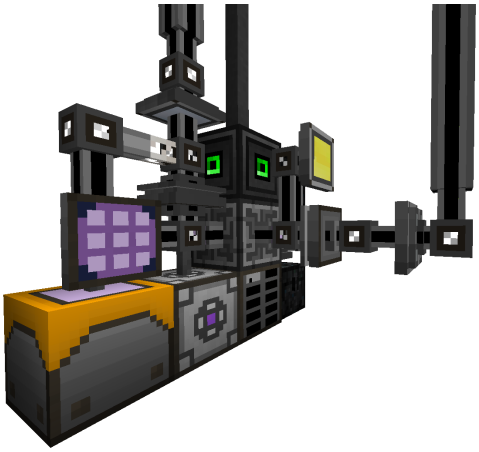
While the above formula will produce the current power usage of machines on an AE network, this should only be taken as an approximation. Even production networks without machines or machines that do not require power will very often produce a non-zero value from the formula above. This is because the values used in calculation (i.e., average power usage, idle power usage) is provided solely by the AE network. In words, the average power usage will be greater than the idle power usage whenever an AE network component (e.g., ME Export Bus, ME Import Bus, ME Interface, ME Storage Bus, etc...) is performing some type of operation. As this is the case, the value returned by the above formula will likely not be one hundred percent accurate.

2. Applied Energistics 2 Infrastructure

The AE2 infrastructure consists of multiple AE2 production networks which are connected by a central AE2 transport network. The transport network is the medium through which material to/from production networks flow. A production network will share one or more products with one or more production networks, and may receive one or more resources from one or more production networks. Transfer of resources between production networks are facilitated by ME Point-to-Point Tunnels (P2P Tunnels). P2P Tunnels are connected directly to the transport network and never directly interact with a production network.

Using multiple production networks has the following two advantages:

- Resource Isolation: No production network has access to all the materials used in the production process. A production network only has access to the materials which are required to perform its part of the production process.
- Monitoring Capabilities: By separating each stage of the process, monitoring the I/O of materials and energy usage of a specific stage within the production process is now possible.



Photograph 2-1. A physical example of an AE production network.

2.1. Network Topology

As stated previously, production networks transfer material to one another by using the transport network. However, the transport network (aside from providing power to the production networks) does not interact with the production networks directly, it exists solely to provide connectivity between the P2P Tunnels. The point at which the P2P Tunnels connect to a production network is called the Handoff Zone. The Handoff Zone is a network which exists between the production network and the transport network which serves to isolate the production networks from each other, and to isolate the production networks from the transport network. The Handoff Zone is comprised of three components: (1) an ME Storage Bus or ME Fluid Storage Bus, (2) an ME Interface or ME Fluid Interface, and (3) N^{th} amount of network cable (which in this case is ME Smart Cable). A Handoff Zone can be configured in two ways: (1) to receive resources, or (2) to share products. These configurations are described in sections 2.2 and 2.3 respectively. For examples, refer to Photograph 2-2, Photograph 2-3, and all other Photograph N-2 photos which are prefixed with the words 'Resource Provision Systems', with the understanding that photos with the aforementioned prefix depict a Handoff Zone which is configured to receive resources.

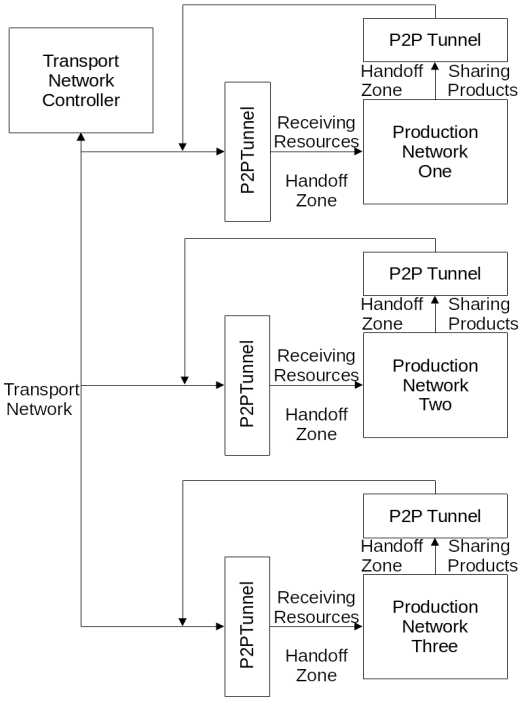


Figure 2-1. Logical topology of the AE transport network and the two different configurations of Handoff Zones.

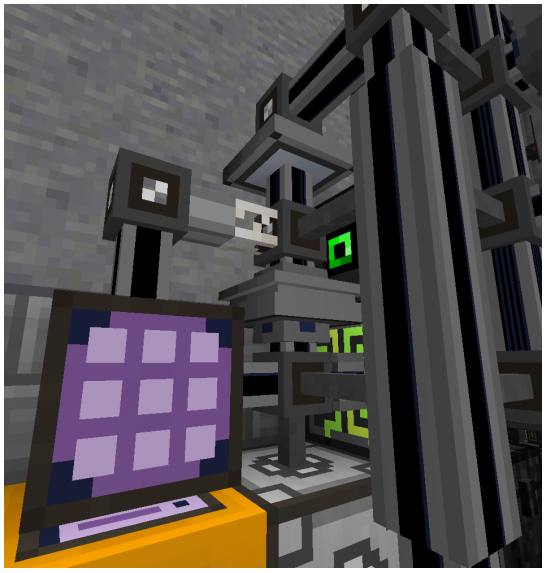
2.2. Receiving Resources

In order for a production network to receive shared resources, one or more P2P Tunnels connect to an ME Interface on the P2P Tunnel side of the connection. Then an ME Storage Bus on the production network side of the connection attaches to the ME Interface, as shown in Photograph 2-2. Note that if fluids are being shared with the production network, ME Fluid Storage Buses, and ME Fluid Interfaces MUST be used to handle fluids, in this configuration the fluid and item ME Interfaces MUST NOT connect to one another (separated by Cable Anchors), as shown in Photograph 11-2.

Photograph 2-2. An ME Storage Bus (left) is connected to an ME Interface (middle), a P2P Tunnel (right) makes available resources from another production network; a typical setup for an AE production network receiving resources from another production network.

2.3. Sharing Products

When a production network shares its product(s) with other production networks it does so by providing an ME Interface on the production network side of the connection, which is configured to only provide one specific item/fluid. Next, an ME Storage Bus on the P2P Tunnel side of the connection attaches to the ME Interface, as shown in Photograph 2-3. The ME Storage Bus is configured for the same item/fluid as the ME Interface, additionally the ME Storage Bus Input/Output Mode setting is set to 'Extract Only'. Note that multiple items/fluids MUST NOT be shared through one P2P Tunnel, each shared product MUST have its own dedicated: P2P Tunnel pair, ME Interface, and ME Storage Bus, for an example see Photograph 7-5. If fluids are being shared you MUST use ME Fluid Storage Buses, and ME Fluid Interfaces.



Photograph 2-3. A P2P Tunnel (top) makes available products to other production networks, an ME Storage Bus (middle) is connected to an ME Interface (bottom); a typical setup for an AE production network sharing its products.

2.4. Interfacing with OpenComputers

Every AE production network, including the AE transport network, is equipped with an Adapter from OpenComputers. Computers which are on the same network as the Adapter are able to access the ME Controller as a component, which provides the methods of the OpenComputers Applied Energistics 2 API.[1] The Adapter is placed directly on one of the six faces of the ME Controller (generally the top face), as shown in Photograph 2-1.

2.5. Production Network Capabilities

A production network provides the following seven capabilities:

- Storage: A production network is able to store the product(s) it produces.
- Share Products: A production network exposes one or more items/fluids to one or more production networks to be used in later stages of production.
- Accept Resources: [When required] A production network accepts one or more items/fluids that are required for the current stage of production.
- Provide Energy: [When required] A production network provides one or more P2P Tunnel pairs to accept and output energy to machinery. By routing energy through the production network, the approximate amount of energy used by machinery can be calculated.
- Network Security: A production network is equipped with an ME Security Terminal to limit access to only authorized individuals.
- Interfaces: A production network will provide an ME Terminal for accessing items within the production network. If preferred, an ME Crafting Terminal may take the place of an ME Terminal.
  [When required] A production network will provide an ME Fluid Terminal for viewing the fluids within the production network.
- Process Monitoring: [Optional] Utilizing OpenComputers, data such as: current stored items, average/idle power usage of the production network, and the average power usage of non-Applied Energistics 2 machines are gathered from the production network.

3. Pulverized Charcoal

The first stage of the production process involves producing Pulverized Charcoal. The following is an outline of the production process:

1. Trees are harvested using Ender IO Farming Stations
2. Harvested materials travel through a Nullifier, with a black-list filter for Oak Logs.
3. Oak Logs pass into an Ender IO Crafter, where they are crafted into four (4) Oak Wood Planks. Oak Wood Planks when pass into three other Crafters.
4. Oak Wood Planks pass into a Crafter to be turned into Sticks.
5. Oak Wood Planks and Sticks pass into a Crafter to be turned into Wooden Axes.
6. Oak Wood Planks and Sticks pass into a Crafter to be turned into Wooden Hoes.
7. The remaining Oak Logs get inserted into the Oak Log buffer chest.
8. An ME Storage Bus attached to the Oak Log buffer chest provides I/O to/from the Oak Log buffer chest to the AE production network.

9 The AE production network inserts Oak Logs into Redstone Furnaces to be turned into Charcoal. Charcoal is then pushed to adjacent Pulverizers.

10 Charcoal is pulverized into Pulverized Charcoal in Pulverizers. Pulverized Charcoal is then imported via ME Import Buses from the Pulverizers into the AE production network.

11 Pulverized Charcoal is then stored on the AE production network.

Pulverized Charcoal is used in the following production stage(s):

- Phyto-Gro

The following machinery is used during this production stage:

- Controller - XNet
- Crafter - Ender IO
- Farming Station - Ender IO
- Nullifier - Thermal Expansion
- Pulverizer - Thermal Expansion
- Redstone Furnace - Thermal Expansion

3.1. Description

The production stage of Pulverized Charcoal uses Farming Stations to harvest Oak Logs and other unwanted materials. An item conduit attached to a Nullifier is configured with a filter card which black-lists Oak Logs, this is how unwanted materials are removed from the process. All Crafters have an insert priority of zero (0), this is especially important for the Crafter which takes Oak Logs as input as it provides the necessary materials to craft more tools for the Farming Stations, as such Oak Logs are inserted into this Crafter first before the Oak Log buffer chest. The Oak Log buffer chest has an insert priority of negative one (-1), as such excess Oak Logs are inserted into this inventory. An ME Storage Bus is connected to the Oak Log buffer chest which makes its contents available to the AE production network. Oak Logs are inserted into Redstone Furnaces using ME Export Buses. These Redstone Furnaces then turn the Oak Logs into Charcoal. The Redstone Furnaces are configured to export their output to adjacent Pulverizers using the Auto-Output setting (found in the Configuration menu of most Thermal Expansion machines). Charcoal is then pulverized into Pulverized Charcoal using said Pulverizers. Pulverized Charcoal is then imported into the AE production network using an ME Import Bus connected to the Pulverizers.

Additionally, there is a Controller present which reads the contents of the Oak Log buffer chest. If the Oak Log buffer chest is full the Farming Stations and Crafters are disabled by disabling a redstone signal. If the Oak Log buffer chest is not full then the Farming Stations and Crafters are enabled by enabling a redstone signal. The Farming Stations and Crafters are configured to be enabled under the presence of a redstone signal. This redstone signal is provided by the Controller which inserts a redstone signal into a Redstone Conduit which in-turn provides the redstone signal to the Farming Stations and Crafters. The rest of the machines are not affected by the redstone signal.

3.2. Operating State Advisory

What follows is a list of one or more Operating States that modify this production system's physical/logical behavior, along with the specific systems modified:

- STANDBY - When this production system is put into this state: all systems defined within the Tool Provision Subsystem from Figure 3-1 are disabled. The aforementioned Controller will (1) immediately disable all systems that are a part of the Tool Provision Subsystem when the Oak Log buffer chest is full, and (2) immediately enable the aforementioned systems when the Oak Log buffer chest is less-than full.

3.3. Flow Charts

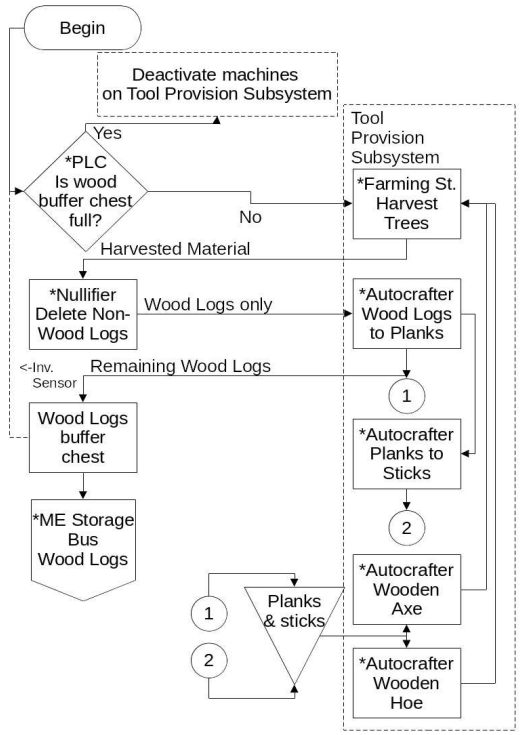


Figure 3-1. Pulverized Charcoal production diagram

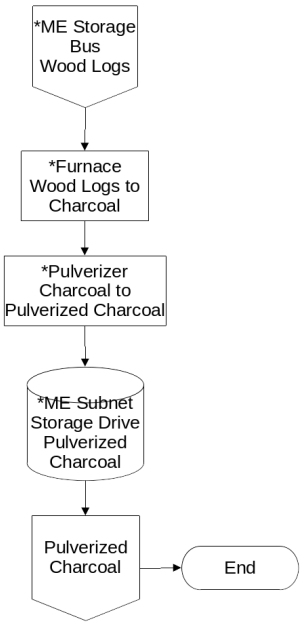
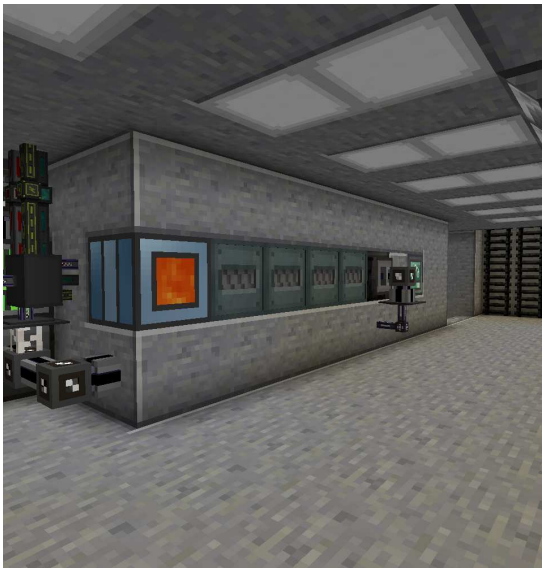
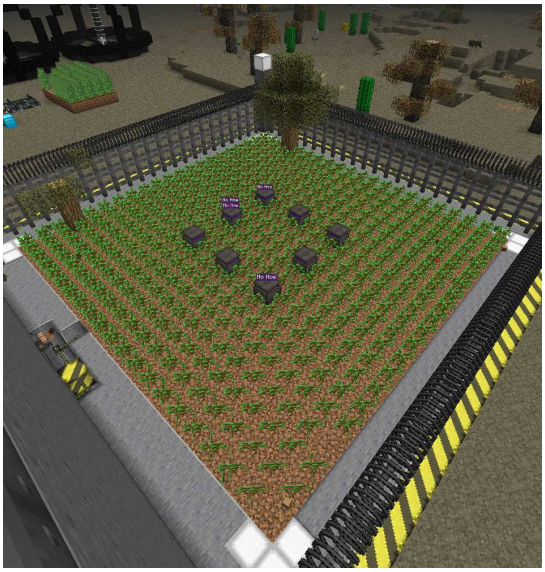


Figure 3-2. Pulverized Charcoal production diagram continued

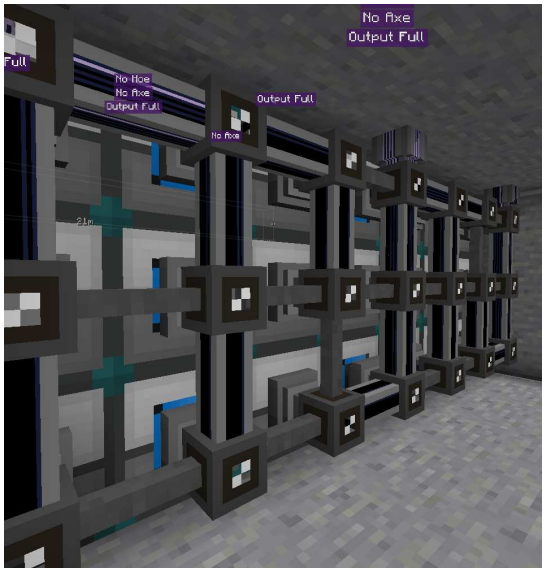
3.4. Setup Photos



Photograph 3-1. Tool Provision Subsystem

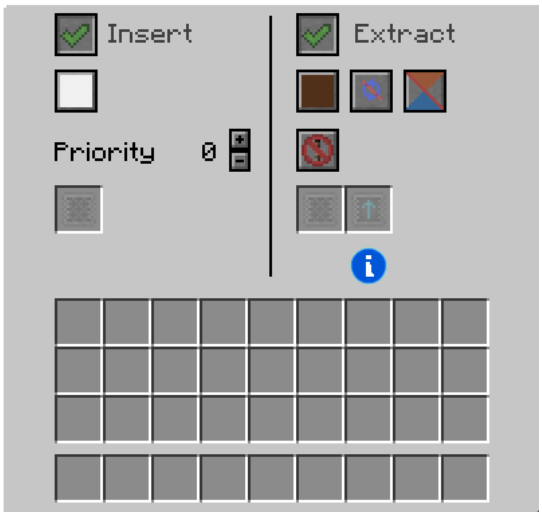


Photograph 3-2. The ideal size of the tree farm (21x21).

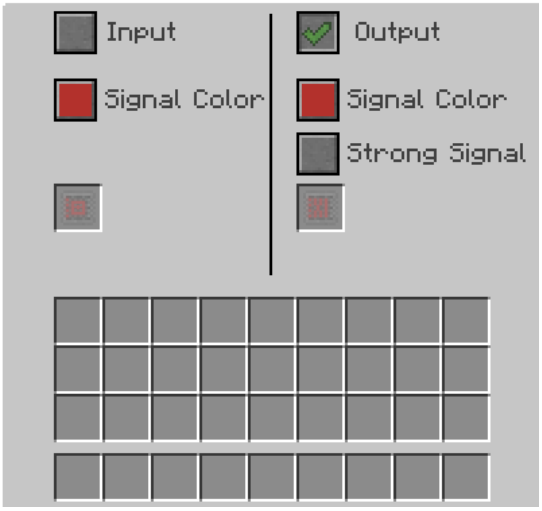


Photograph 3-3. Unlike other processes, no buffer chests are used, instead input/output is done directly by ME Export and ME Import Buses respectively.

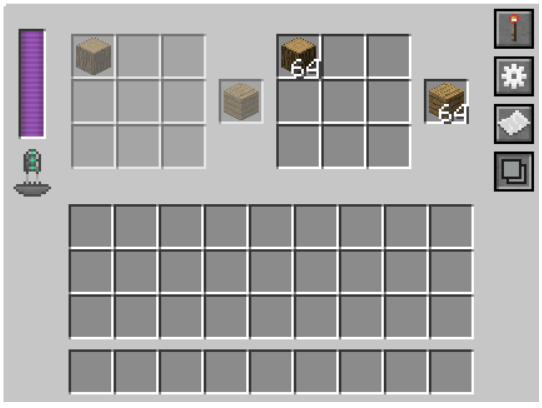
Configuration 3-1-1. Farming Station configuration.



Configuration 3-1-2. Item Conduit configuration for the Farming Stations.



Configuration 3-1-3. Redstone Conduit configuration for the Farming Stations.



Configuration 3-2-1. Crafter - Oak Wood to Oak Wood Planks

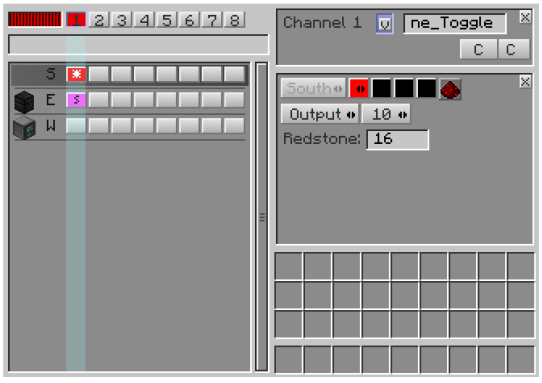
Configuration 3-2-2. Crafter - Oak Wood Planks to Sticks

Configuration 3-2-3. Crafter - Wood Axe

Configuration 3-2-4. Crafter - Wood Hoe

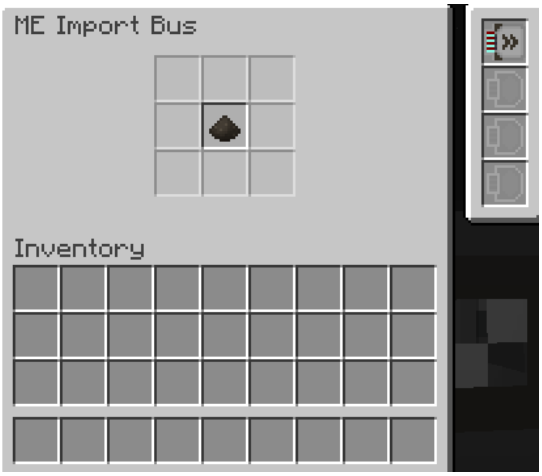
Configuration 3-3. Configuration for Oak Logs buffer chest ME Storage Bus.

Configuration 3-4-1. XNet Controller sensor configuration.

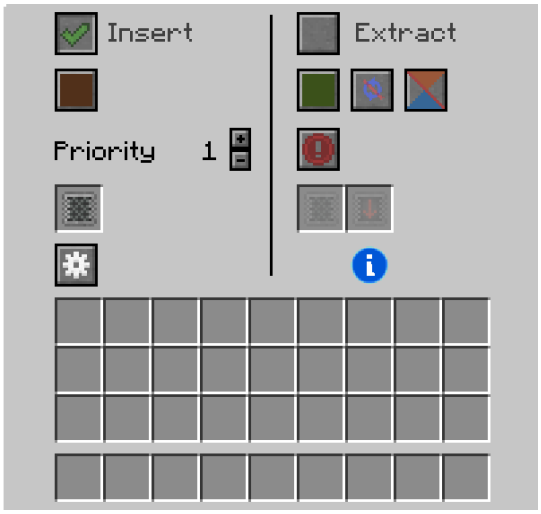


Configuration 3-4-2. XNet Controller redstone output.

Configuration 3-5. Redstone Furnace ME Export Bus (Oak Logs)

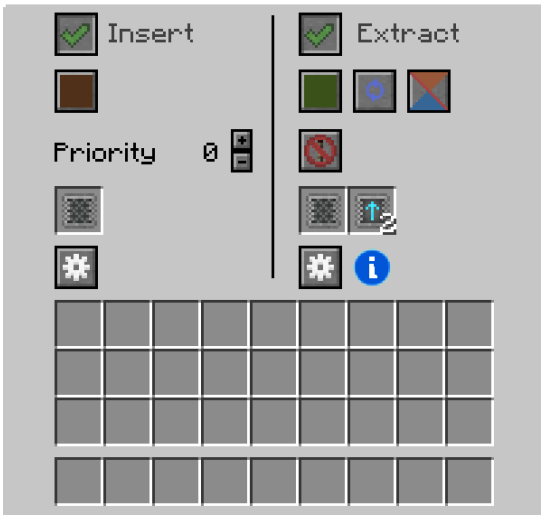


Configuration 3-6. Pulverizer ME Import Bus (Pulverized Charcoal)



Configuration 3-7-1. Nullifier Item Conduit configuration

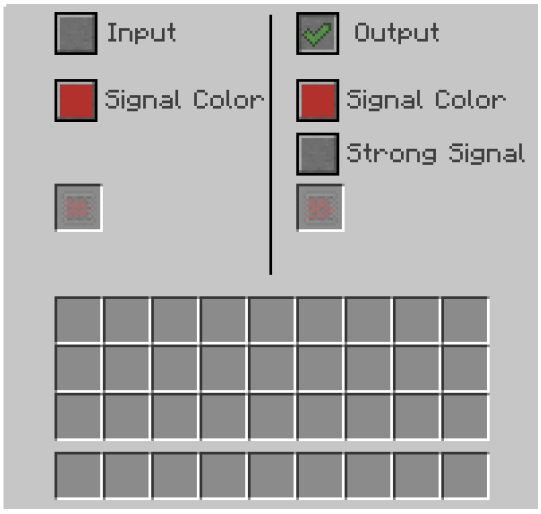
Configuration 3-7-2. Nullifier Item Conduit filter configuration



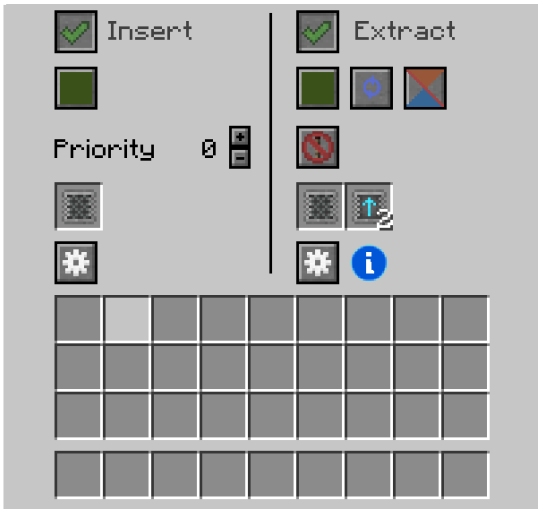
Configuration 3-8-1. Item Conduit configuration for Oak Logs to Oak Planks Crafter.

Configuration 3-8-2. Item Conduit Insert filter configuration for Oak Logs to Oak Planks Crafter.

Configuration 3-8-3. Item Conduit Extract filter configuration for Oak Logs to Oak Planks Crafter.



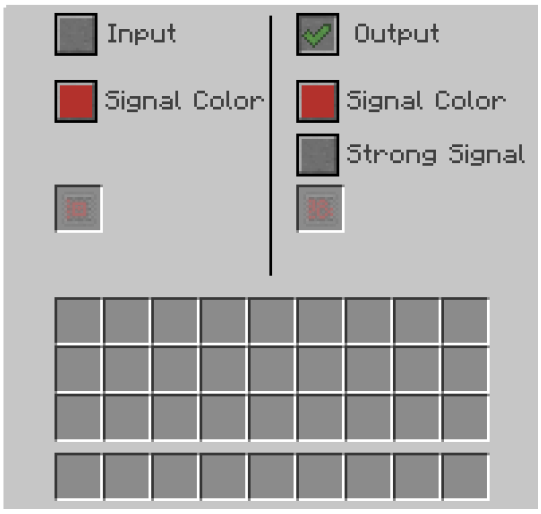
Configuration 3-8-4. Redstone Conduit configuration for Oak Logs to Oak Planks Crafter.



Configuration 3-9-1. Item Conduit configuration for Oak Planks to Sticks Crafter.

Configuration 3-9-2. Item Conduit Insert filter configuration for Oak Planks to Sticks Crafter.

Configuration 3-9-3. Item Conduit Extract filter configuration for Oak Planks to Sticks Crafter.

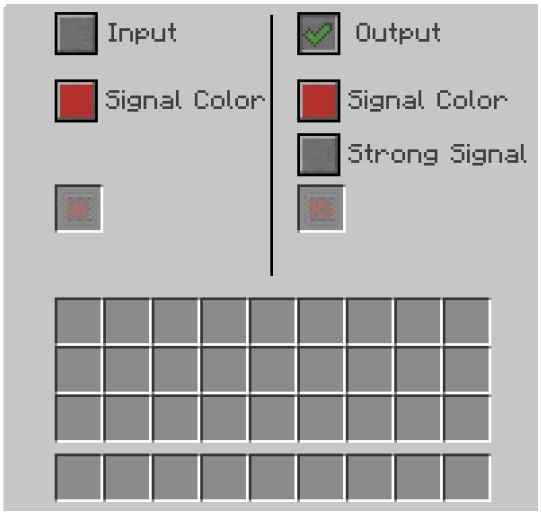


Configuration 3-9-4. Redstone Conduit configuration for Oak Planks to Sticks Crafter.

Configuration 3-10-1. Item Conduit configuration for Wood Axe Crafter.

Configuration 3-10-2. Item Conduit Insert filter configuration for Wood Axe Crafter.

Configuration 3-10-3. Item Conduit Extract filter configuration for Wood Axe Crafter.

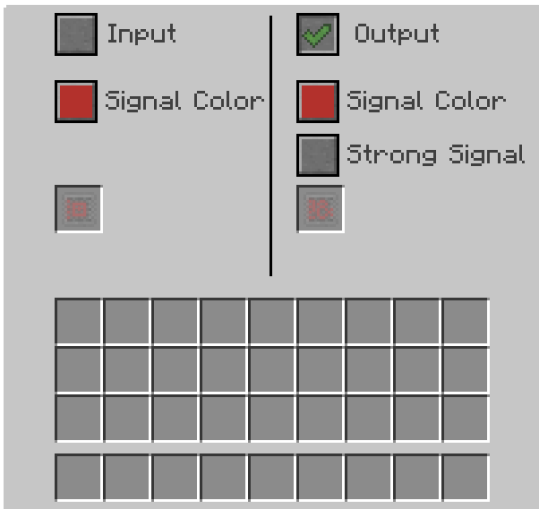


Configuration 3-10-4. Redstone Conduit configuration for Wood Axe Crafter.

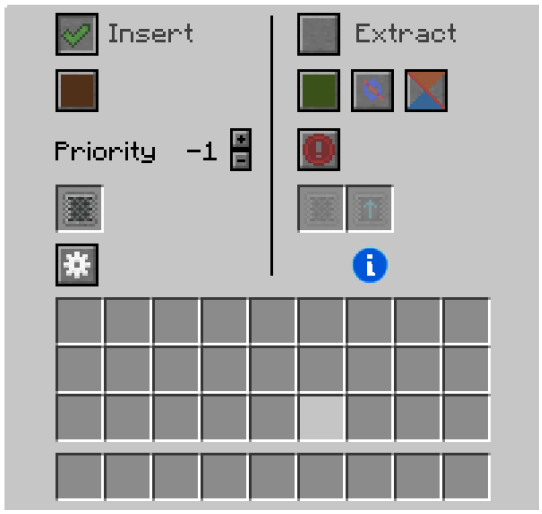
Configuration 3-11-1. Item Conduit configuration for Wood Hoe Crafter.

Configuration 3-11-2. Item Conduit Insert filter configuration for Wood Hoe Crafter.

Configuration 3-11-3. Item Conduit Extract filter configuration for Wood Hoe Crafter.

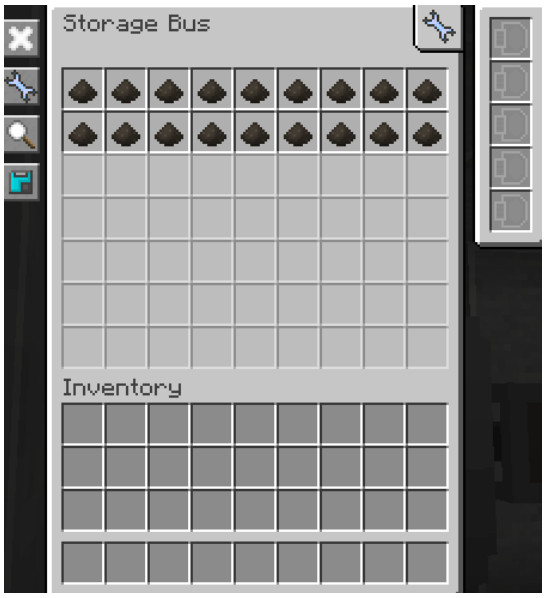


Configuration 3-11-4. Redstone Conduit configuration for Wood Hoe Crafter.

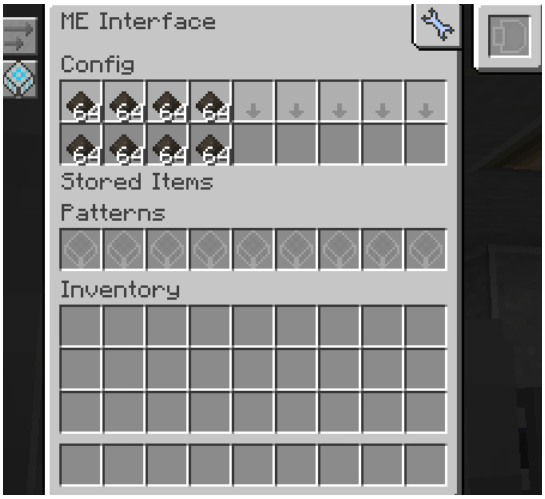


Configuration 3-12-1. Item Conduit configuration for Wood Logs buffer chest.

Configuration 3-12-2. Item Conduit Insert filter configuration for Wood Logs buffer chest.



Configuration 3-13-1. Product - Pulverized Charcoal - ME Storage Bus



Configuration 3-13-2. Product - Pulverized Charcoal - ME Interface

4. Cobblestone

The second stage of the production process involves producing Cobblestone. The following is an outline of the production process:

1 Lava/Water placed in a checker-board pattern separated by one (1) Cobblestone block.

2 Extra Utilities 2 Transfer Nodes (Items) are placed on the top face of each Cobblestone block.

3 Transfer Nodes (Items) create Cobblestone blocks, then insert them into a Cobblestone buffer chest.

4 Cobblestone within the Cobblestone buffer chest is imported and stored in the AE production network.

Cobblestone is used in the following production stage(s):

- Sand
- Slag

The following machinery is used during this production stage:

- Transfer Node (Items) - Extra Utilities 2

4.1. Description

A Cobblestone generator is used in this production stage, which uses lava/water in a checker board pattern separated by one (1) block of Cobblestone. Extra Utilities Transfer Nodes (Items) are placed on the top face of each Cobblestone block. The Extra Utilities Transfer Nodes (Items) are able to generate Cobblestone using the 'Upgrade Mining' upgrade plus several 'Upgrade

Speed' upgrades. Transfer Nodes (Items) then feed into the Cobblestone buffer chest, Cobblestone from this chest are then imported into the AE production network for storage.

Note that Extra Utilities 2 uses its own energy system: Global Power (GP). GP is bound to the player and is accessible from anywhere in-game, because of this the generators used to produce GP are not required to be on site. If the consumption of GP is greater than the production of GP, every Extra Utilities 2 machine that consumes GP will not function. This can be fixed by adding additional GP generators. Make sure you have enough GP available to power the Transfer Nodes.

4.2. Flow Charts

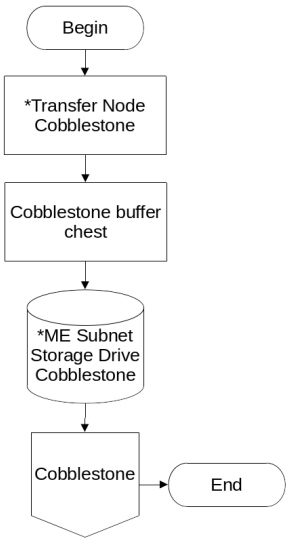
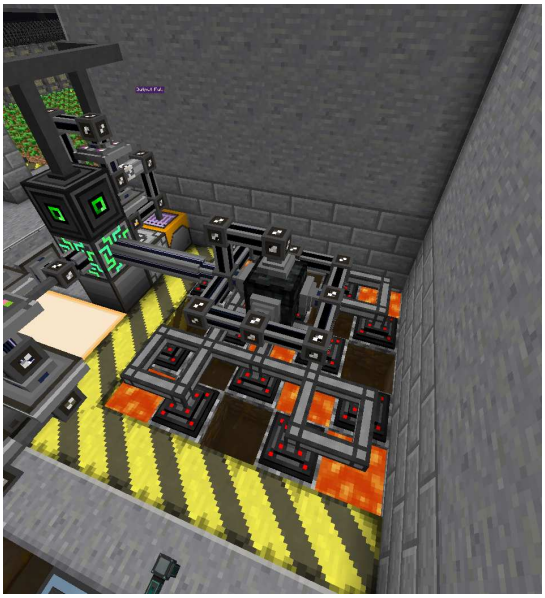


Figure 4-1. Cobblestone Production Diagram

4.3. Setup Photos

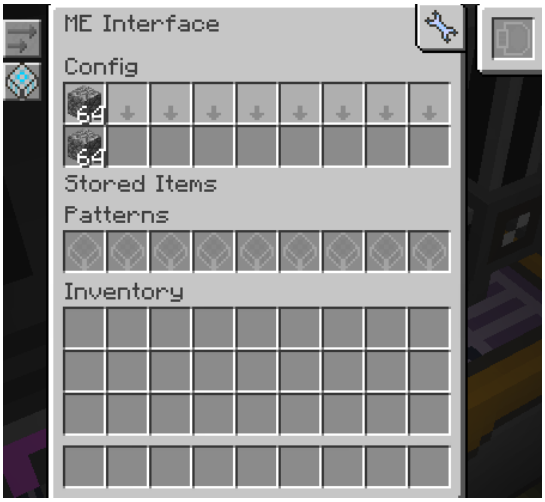


Photograph 4-1. Cobblestone production system. Transfer Nodes generate Cobblestone then insert it into the chest.

Configuration 4-1. Transfer Nodes (Items) configuration.

Configuration 4-2. Cobblestone buffer chest ME Import Bus configuration.

Configuration 4-3-1. Product - Cobblestone - ME Storage Bus



Configuration 4-3-2. Product - Cobblestone - ME Interface

5. Sand

The third stage of the production process involves producing Sand. The following is an outline of the production process:

1 Cobblestone is pulverized into Gravel in Pulverizers, a by-product of this process is Sand.

2 The Sand by-product from the previous stage is inserted into a Sand by-product buffer chest. This buffer chest feeds into the Main Sand buffer chest.

3 Gravel is inserted into another set of Pulverizers, Gravel is then pulverized into Sand. A by-product of this process is Flint.

4 The Flint by-product from the previous stage is inserted into a Nullifier.

5 The Sand from step 3 is inserted into the Main Sand buffer chest.

6 Sand within the Main Sand buffer chest is imported and stored in the AE production network.

Sand is used in the following production stage(s):

- Sandstone

The following machinery is used during this production stage:

- Nullifier - Thermal Expansion
- Pulverizer - Thermal Expansion

5.1. Description

In this production stage, two sets of Pulverizers are stacked on top of each other in alternating rows. The first set pulverises Cobblestone into Gravel, the second set pulverises Gravel into Sand. During the first set, Sand is produced as a by-product which is then extracted and inserted into the Sand by-product buffer chest. The second set produces Flint as a by-product, which is then inserted into a Nullifier. The first set feeds Gravel into the second set, Sand is extracted from the second set and inserted into the Main Sand buffer chest.

5.2. Flow Charts

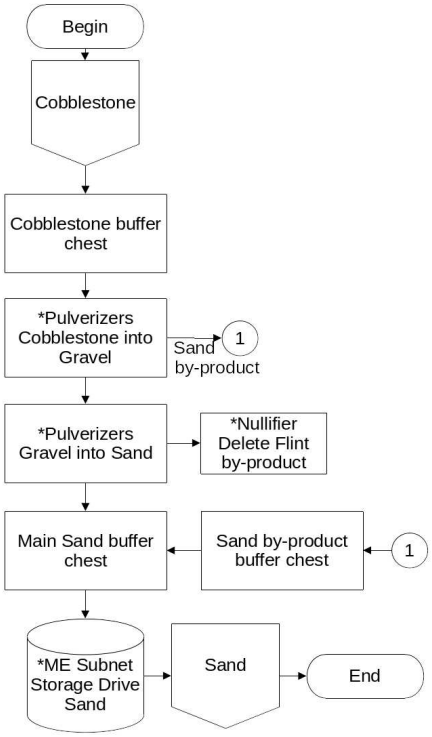
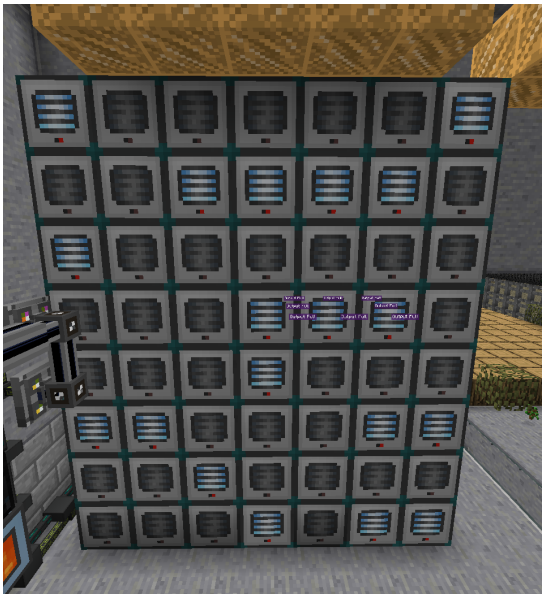
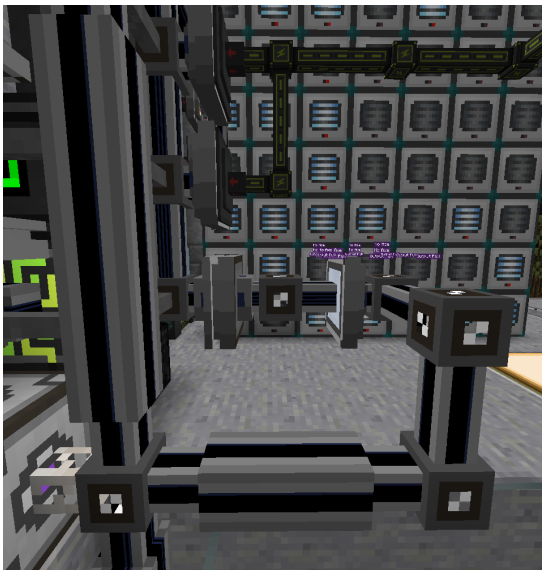


Figure 5-1. Sand Production Diagram

5.3. Setup Photos



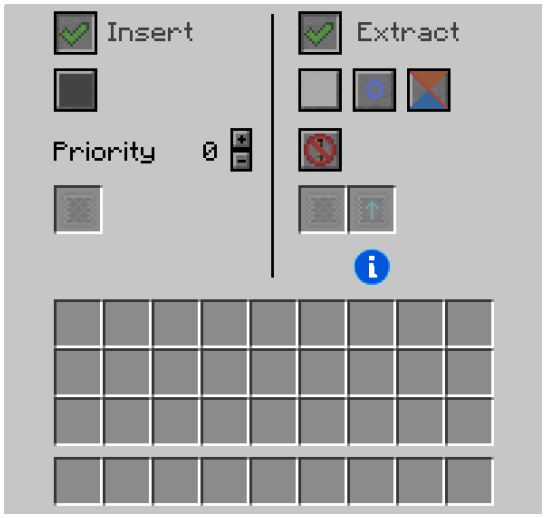
Photograph 5-1. Sand production systems



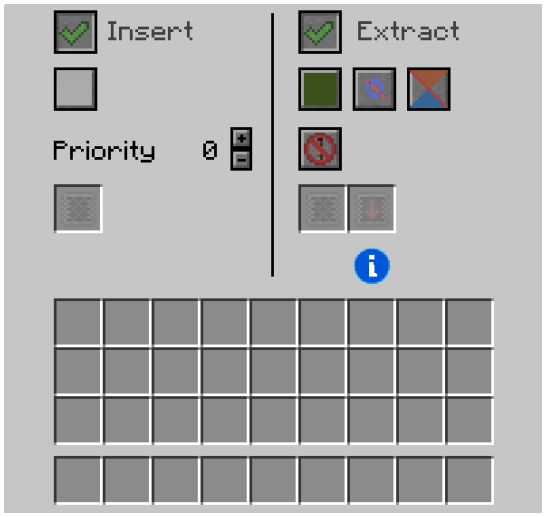
Photograph 5-2. Resource Provision Systems; P2P Tunnel (right) provides Cobblestone.

Photograph 5-3. Cobblestone buffer chest (top-left), sand by-product buffer chest (top-right), Nullifier (middle-right), and Main Sand buffer chest (bottom-left).

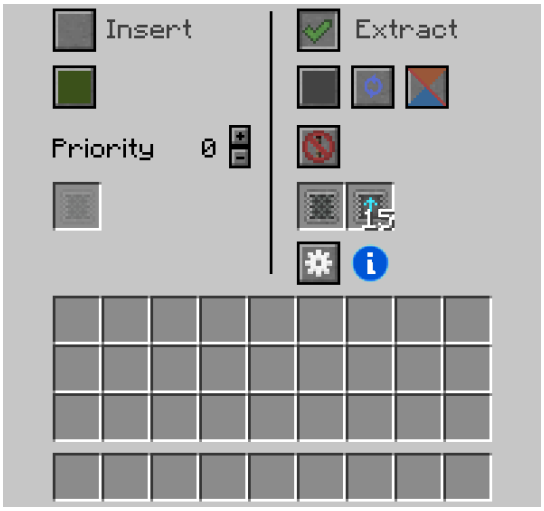
Configuration 5-1. Pulverizers augment configuration.



Configuration 5-2. Item Conduit configuration for Cobblestone-to-Gravel Pulverizers.

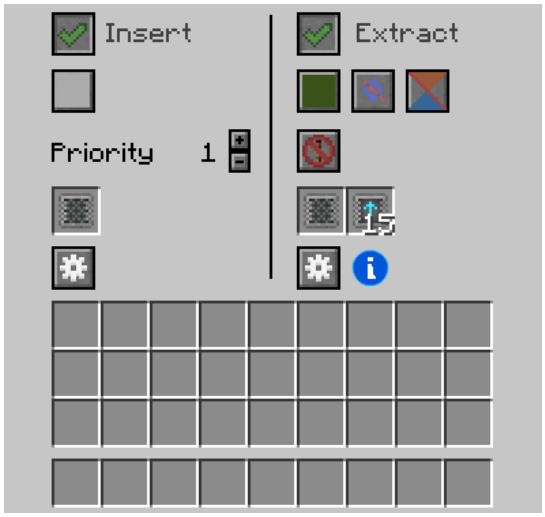


Configuration 5-3. Item Conduit configuration for Gravel-to-Sand Pulverizers.



Configuration 5-4-1. Item Conduit configuration for Cobblestone buffer chest.

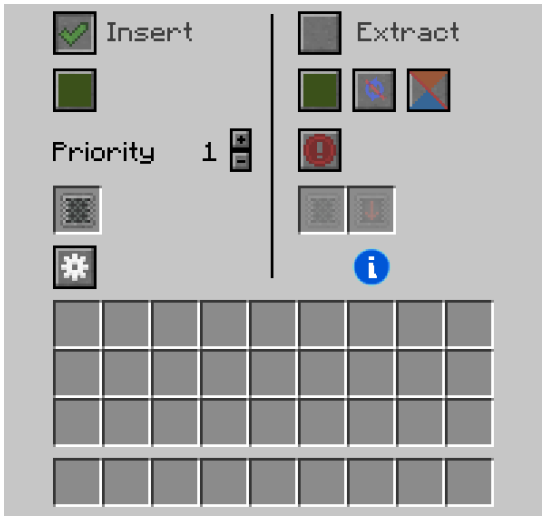
Configuration 5-4-2. Item Conduit extract filter configuration for Cobblestone buffer chest.



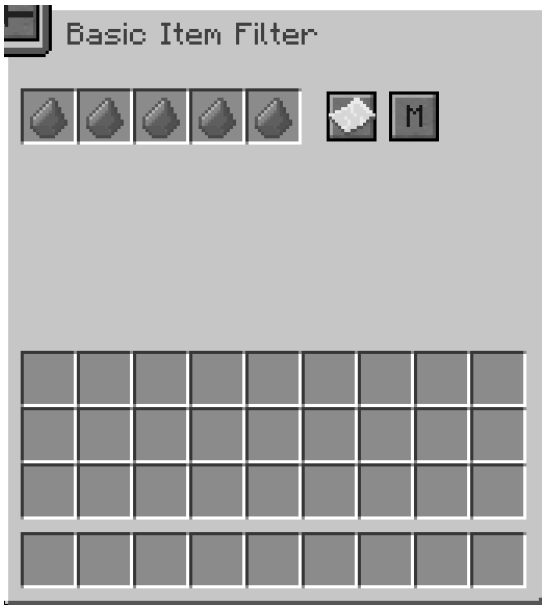
Configuration 5-5-1. Item Conduit configuration for Sand By-product buffer chest.

Configuration 5-5-2. Item Conduit insert filter configuration for Sand By-product buffer chest.

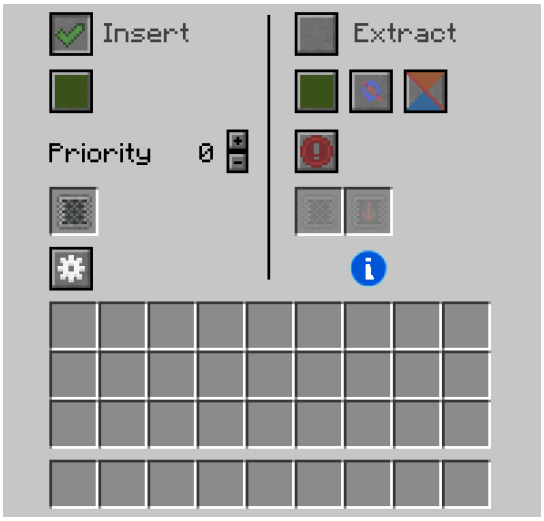
Configuration 5-5-3. Item Conduit extract filter configuration for Sand By-product buffer chest.



Configuration 5-6-1. Item Conduit configuration for Nullifier.



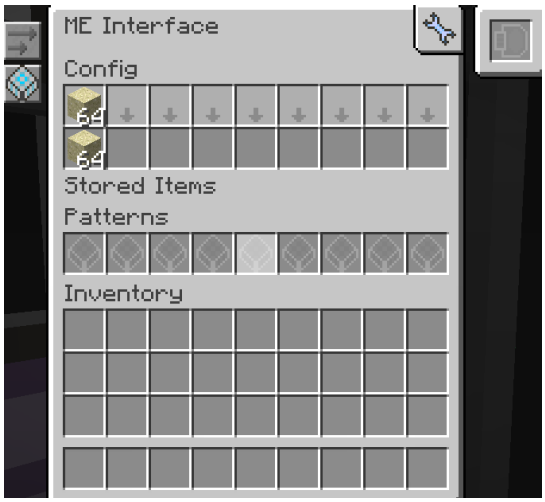
Configuration 5-6-2. Item Conduit insert filter configuration for Nullifier.



Configuration 5-7-1. Item Conduit configuration for Main Sand buffer chest.

Configuration 5-7-2. Item Conduit configuration for Main Sand buffer chest.

Configuration 5-8-1. Product - Sand - ME Storage Bus



Configuration 5-8-2. Product - Sand - ME Interface

6. Sandstone

The fourth stage of the production process involves crafting Sandstone. The following is an outline of the production process:

1 Sand is inserted into Ender IO Crafters.

2 Ender IO Crafters craft 4 Sand into Sandstone.

3 Sandstone from the Ender IO Crafters is inserted into the Sandstone buffer chest.

4 Sandstone within the Sandstone buffer chest is imported and stored in the AE production network.

Sandstone is used in the following production stage(s):

- Niter

The following machinery is used during this production stage:

- Crafter - Ender IO

6.1. Description

This stage of production uses Crafters, which take four (4) Sand and craft it into Sandstone, which is then inserted into the Sandstone buffer chest.

6.2. Flow Charts

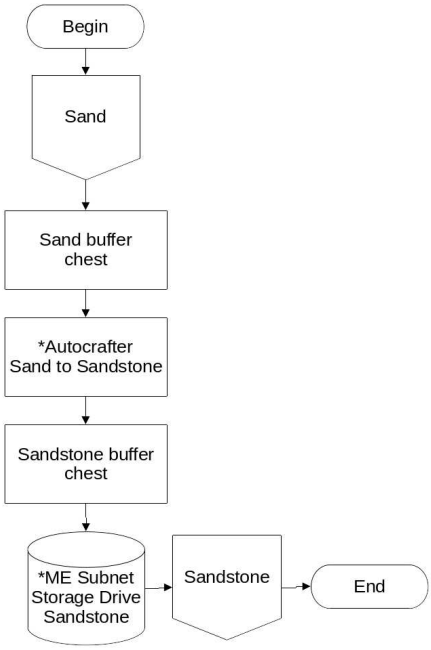
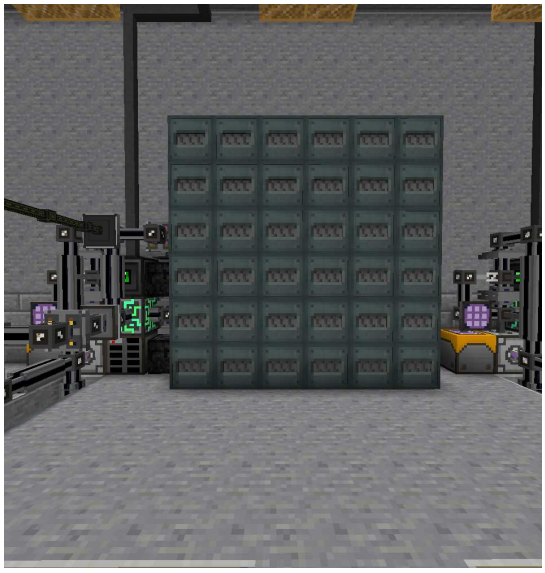
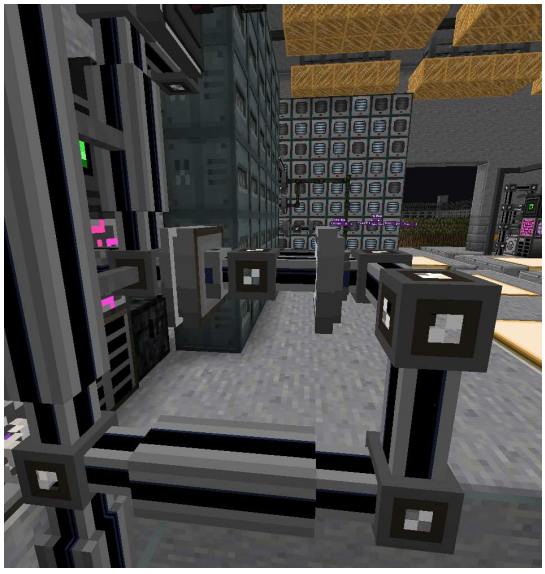


Figure 6-1. Sandstone Production Diagram

6.3. Setup Photos

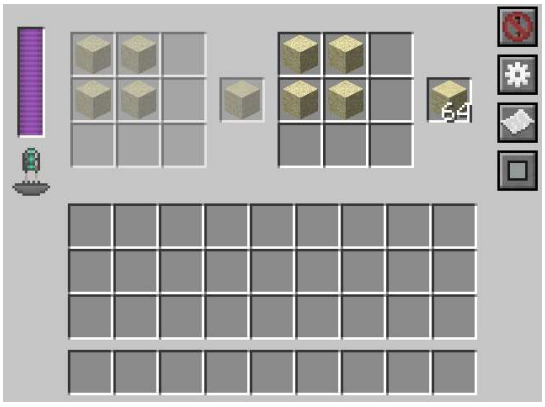


Photograph 6-1. Sandstone production systems

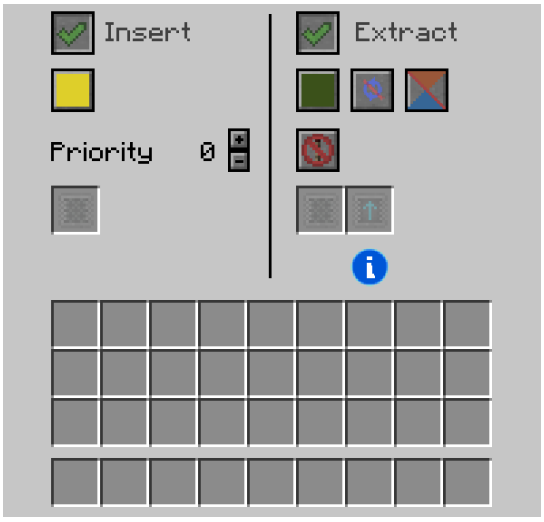


Photograph 6-2. Resource Provision Systems; P2P Tunnel (right) provides Sand.

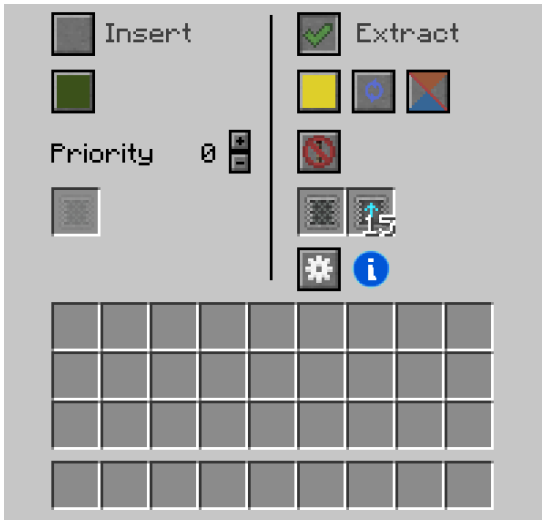
Photograph 6-3. Sand buffer chest (top), and Sandstone buffer chest (bottom).



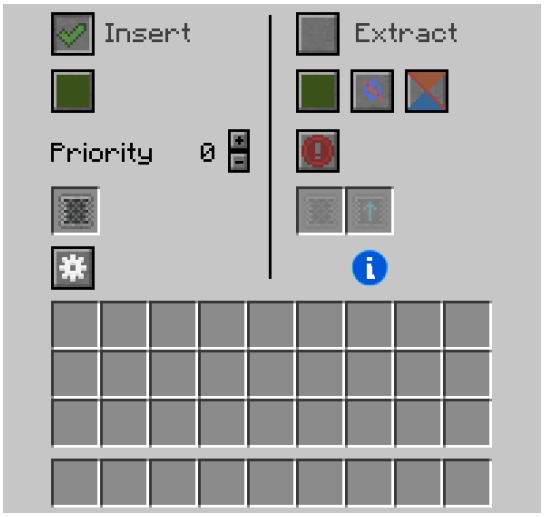
Configuration 6-1. Crafters - Sandstone



Configuration 6-2. Item Conduit configuration for Crafters.



Configuration 6-3-1. Item Conduit configuration for Sand buffer chest.



Configuration 6-4-1. Item Conduit configuration for Sandstone buffer chest.

Configuration 6-3-2. Item Conduit extract filter configuration for Sand buffer chest.

Configuration 6-4-2. Item Conduit insert filter configuration for Sandstone buffer chest.

Configuration 6-5-1. Product - Sandstone - ME Storage Bus

Configuration 6-5-2. Product - Sandstone - ME Interface

7. Niter

The fifth stage of the production process involves producing Niter. The following is an outline of the production process:

1 Sandstone is Pulverized into Sand, the by-product of this process is Niter.

2 Sand from the previous stage is inserted into the Sand buffer chest, this chest is connected to an XNet Controller which reads the amount of Sand in the chest. If the amount of Sand is greater-than or equal to the capacity of the chest then 64 Sand from the first inventory slot is inserted into a Nullifier. If there is space in the AE production network to store the excess Sand, it will be imported into the AE production network using an ME Import Bus.

3 The Niter from step 1 is inserted into the Niter buffer chest.

4 Niter within the Niter buffer chest is imported and stored in the AE production network.

Niter is used in the following production stage(s):

- Phyto-Gro

Sand is used in the following production stage(s):

- Slag

The following machinery is used during this production stage:

- Controller - XNet
- Nullifier - Thermal Expansion
- Pulverizer - Thermal Expansion

7.1. Description

This production stage makes use of Pulverizers and XNet. When a Pulverizer pulverises Sandstone it has a base chance of 40% to produce Niter as a by-product. To increase the chance of producing Niter each of the Pulverizers use three (3) Auxiliary Sieve augments, raising the chance to produce Niter to 72%.[2]

Since Sand is the main product of the Sandstone-pulverizing process (two (2) Sand per Sandstone) it is stored in the Sand buffer chest. To ensure the Sand within the Pulverizers will always be removed an XNet Controller reads the contents of the Sand buffer chest. When the Sand buffer chest reaches capacity the XNet controller enables the Nullifier, extracts 64 Sand from the first inventory slot in the Sand buffer chest, and inserts that Sand into the Nullifier. Of course, if there is room in the AE production network to import Sand, it will do so.

7.2. Flow Charts

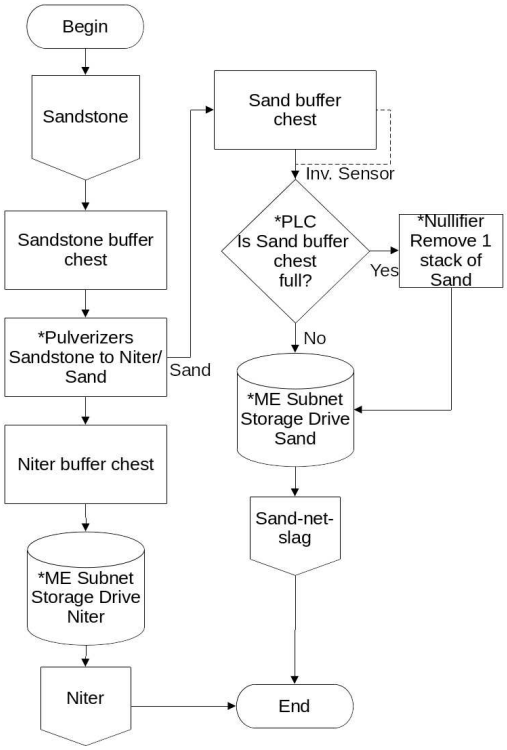
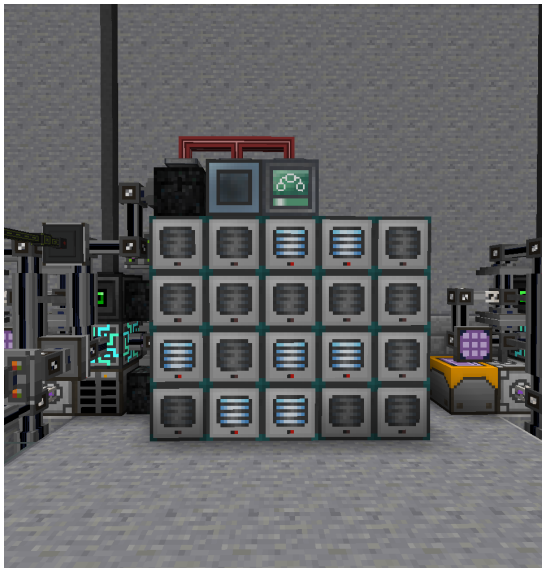


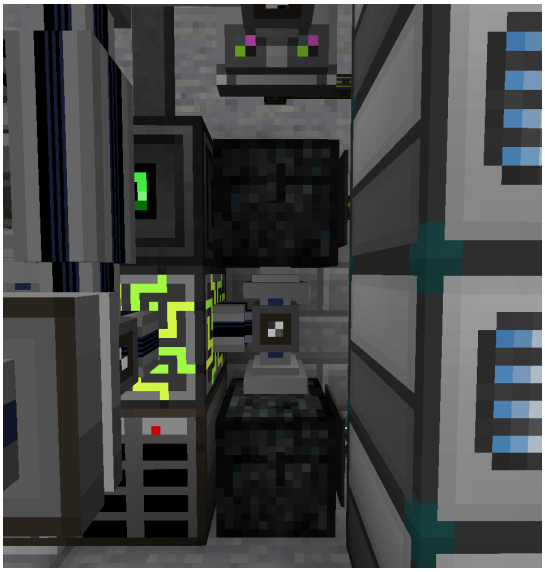
Figure 7-1. Niter Production Diagram

7.3. Setup Photos

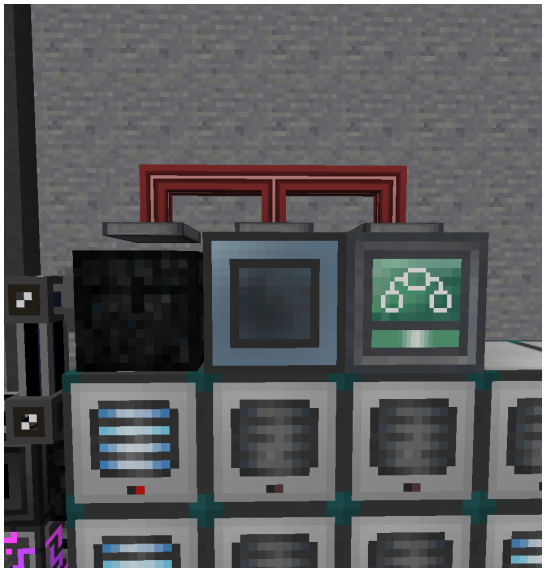


Photograph 7-1. Niter production systems

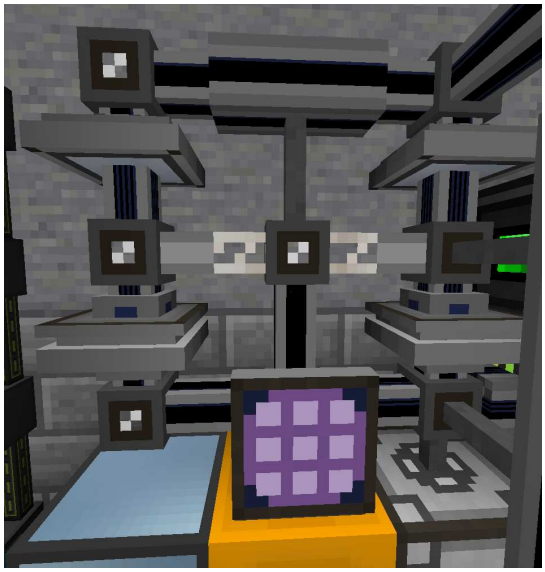
Photograph 7-2. Resource Provision Systems; P2P Tunnel (right) provides Sandstone.



Photograph 7-3. Sandstone buffer chest (top), and Niter buffer chest (bottom).

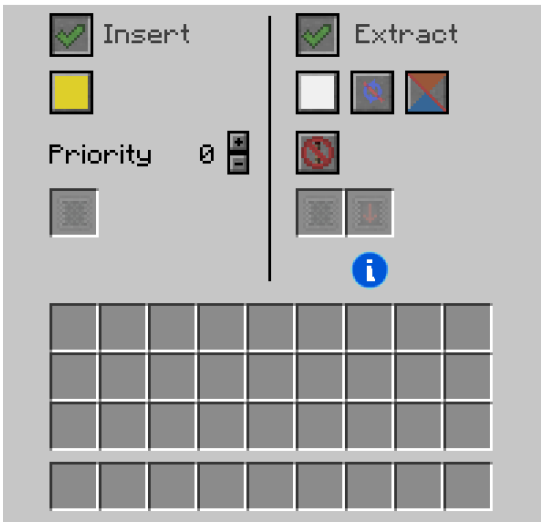


Photograph 7-4. Sand buffer chest (left), Nullifier (middle), Controller (right).

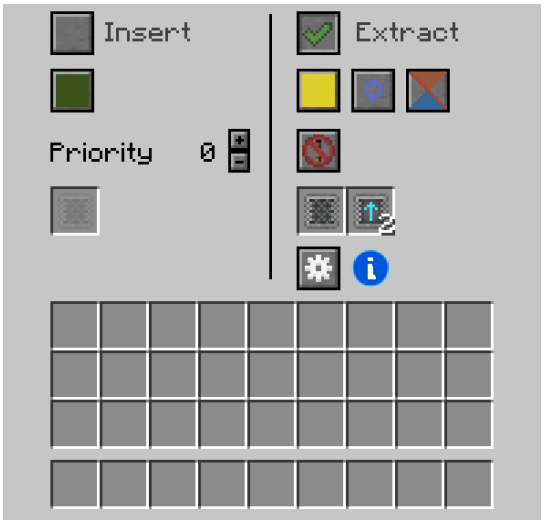


Photograph 7-5. Left-side: Sand product export systems, Right-side: Niter product export systems.

Configuration 7-1-1. Pulverizers augment configuration.



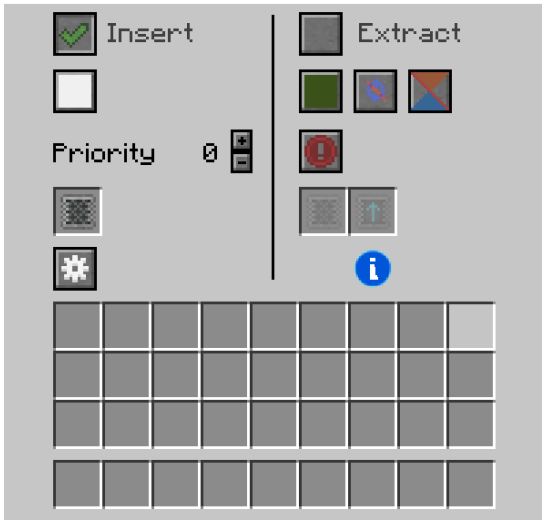
Configuration 7-1-2. Item Conduit configuration for Pulverizers.



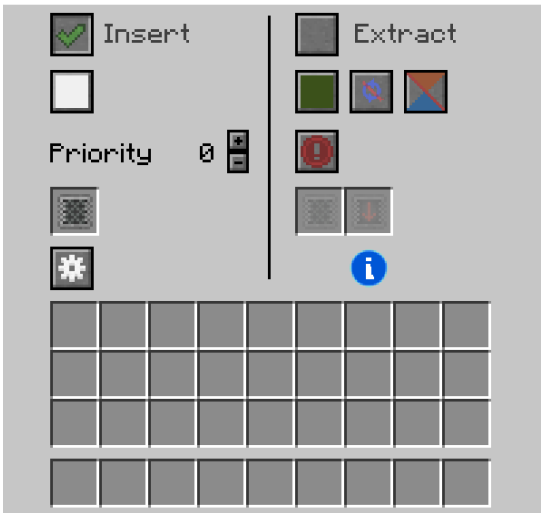
Configuration 7-2-1. Item Conduit configuration for Sandstone buffer chest.

Configuration 7-2-2. Item Conduit extract filter configuration for Sandstone buffer chest.

Configuration 7-3-2. Item Conduit insert filter configuration for Niter buffer chest.



Configuration 7-3-1. Item Conduit configuration for Niter buffer chest.

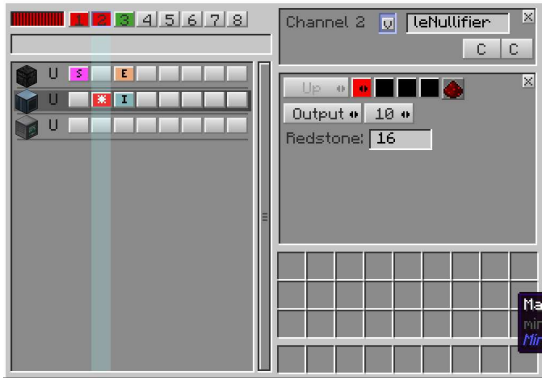


Configuration 7-4-1. Item Conduit configuration for Sand buffer chest.

Configuration 7-4-2. Item Conduit insert filter configuration for Sand buffer chest.

Configuration 7-5-1. Controller inventory sensor configuration for Sand buffer chest.

Configuration 7-5-2. Controller inventory extraction configuration for Sand buffer chest.



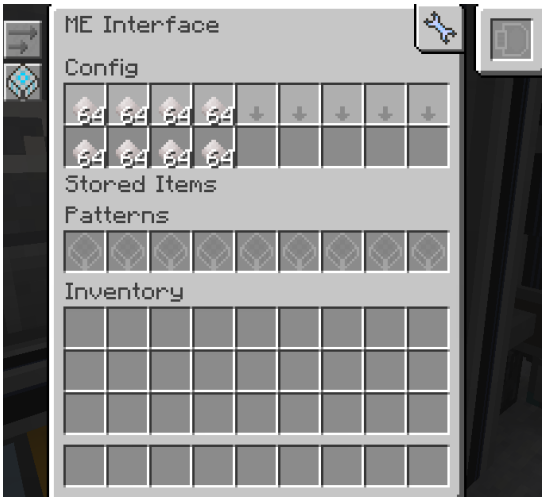
Configuration 7-5-3. Controller redstone output configuration.

Configuration 7-5-4. Controller inventory insertion configuration for Nullifier.

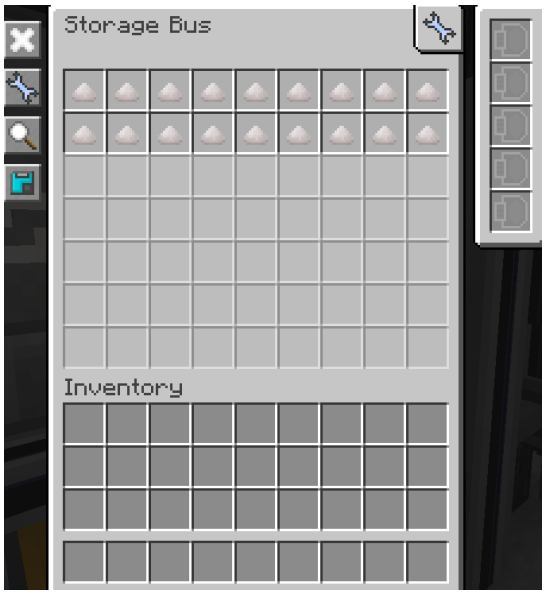
Configuration 7-6-1. Nullifier redstone control configuration.

Configuration 7-6-2. Nullifier I/O configuration.

Configuration 7-7. Sand buffer chest ME Import Bus configuration.



Configuration 7-8-2. Product - Niter - ME Interface.



Configuration 7-8-1. Product - Niter - ME Storage Bus.

Configuration 7-9-1. Product - Sand - ME Storage Bus

Configuration 7-9-2. Product - Sand - ME Interface

8. Slag

The sixth stage of the production process involves producing Slag. The following is an outline of the production process:

1 Induction Smelters take Sand and Cobblestone to produce Stone Bricks, the by-product of this process is Slag.

2 Stone Bricks are inserted into a Nullifier.

3 Slag from step 1 is inserted into the Slag buffer chest.

4 Slag within the Slag buffer chest is imported and stored in the AE production network.

Slag is used in the following production stage(s):

- Phyto-Gro

The following machinery is used during this production stage:

- Induction Smelter - Thermal Expansion
- Nullifier - Thermal Expansion

8.1. Description

Induction Smelters are used in the production of Slag. Induction Smelters take Sand and Cobblestone to produce Stonebricks and Slag. Stonebricks are inserted into a Nullifier and Slag is inserted into the Slag buffer chest. Even though Slag is a by-product of this process, it has a 100% chance to be produced.

8.2. Flow Charts

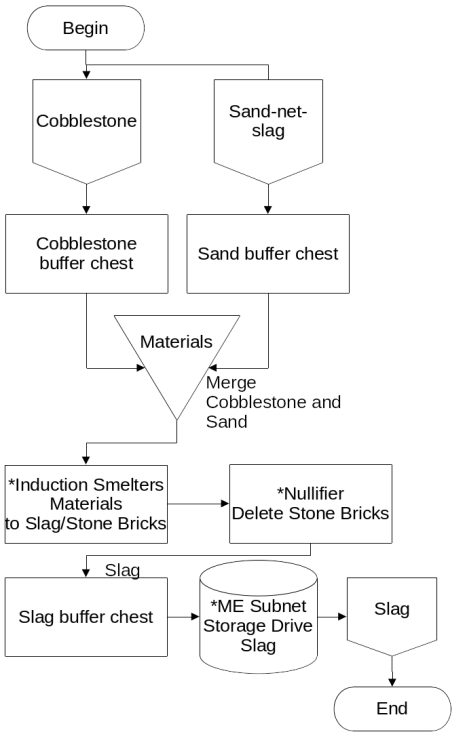
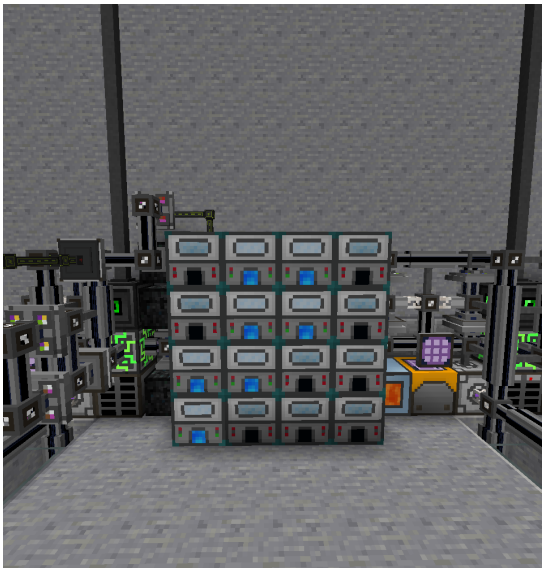
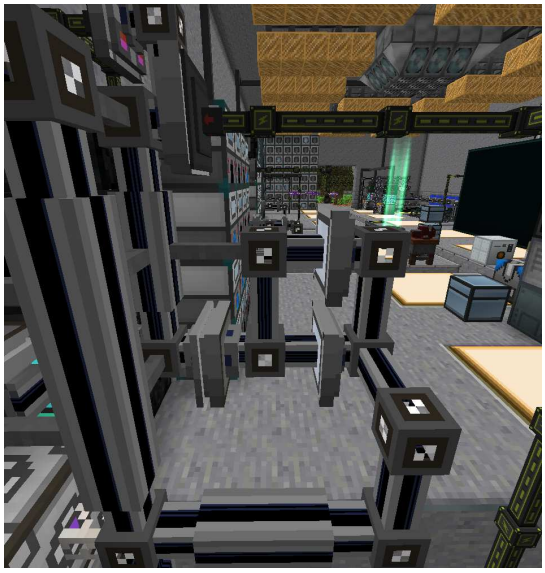


Figure 8-1. Slag Production Diagram

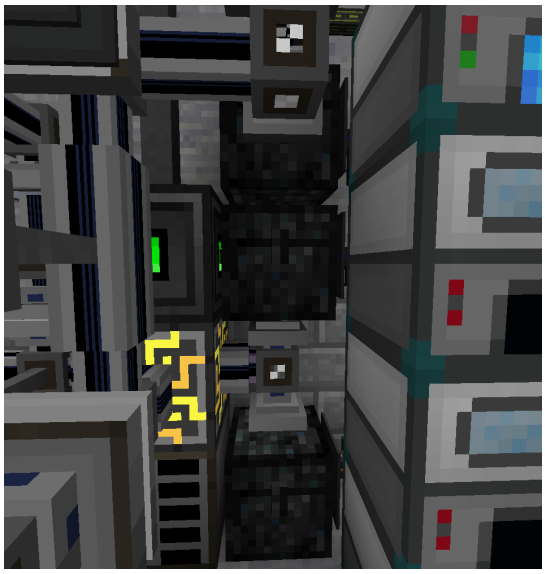
8.3. Setup Photos



Photograph 8-1. Slag production systems

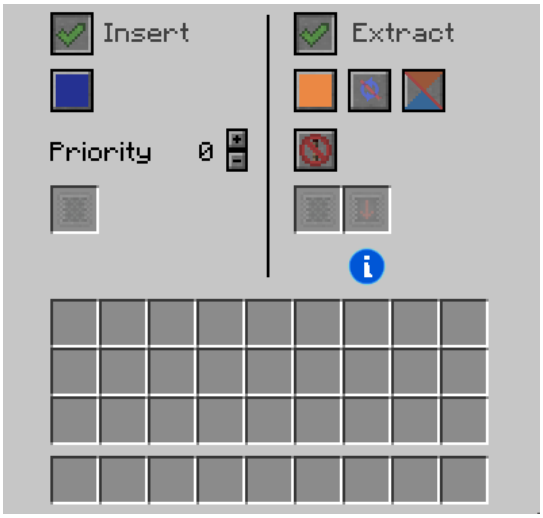


Photograph 8-2. Resource Provision Systems; P2P Tunnel (right-bottom) provides Cobblestone, P2P Tunnel (right-top) provides Sand.

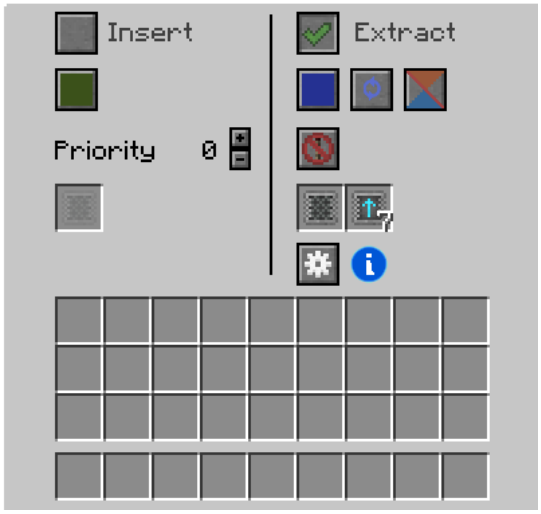


Photograph 8-3. Sand buffer chest (top), Cobblestone buffer chest (middle), and Slag buffer chest (bottom).

Configuration 8-1-1. Induction Smelters augment configuration.



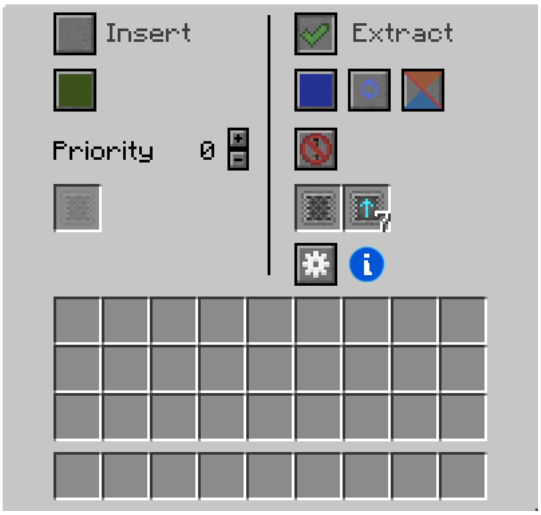
Configuration 8-1-2. Item Conduit configuration for Induction Smelters.



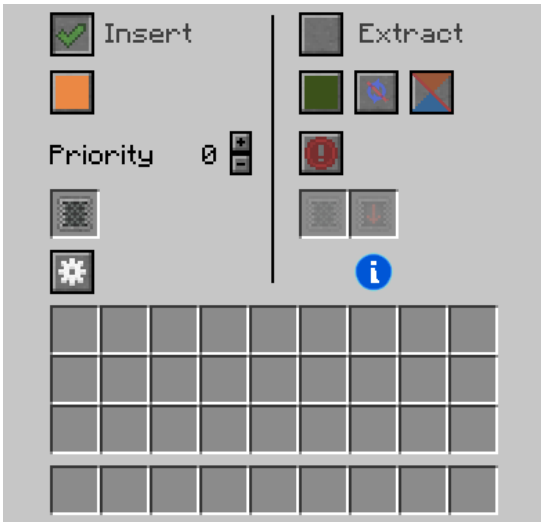
Configuration 8-2-1. Item Conduit configuration for Sand buffer chest.

Configuration 8-2-2. Item Conduit extract filter configuration for Sand buffer chest.

Configuration 8-3-2. Item Conduit extract filter configuration for Cobblestone buffer chest.



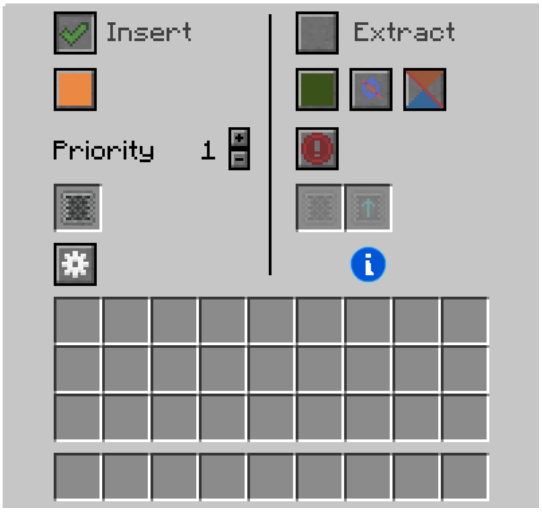
Configuration 8-3-1. Item Conduit configuration for Cobblestone buffer chest.



Configuration 8-4-1. Item Conduit configuration for Slag buffer chest.

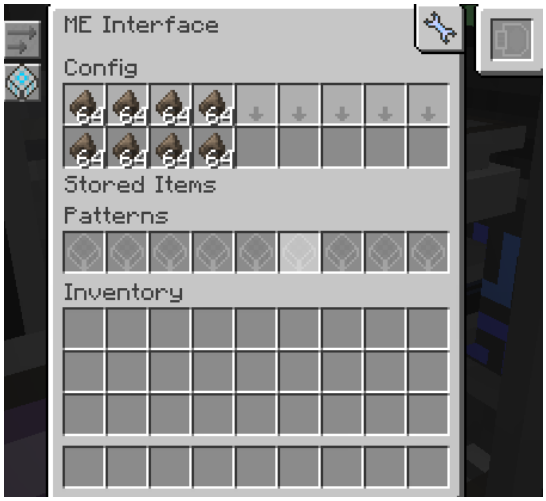
Configuration 8-4-2. Item Conduit insert filter configuration for Slag buffer chest.

Configuration 8-5-2. Item Conduit insert filter configuration for Nullifier.



Configuration 8-5-1. Item Conduit configuration for Nullifier.

Configuration 8-6-1. Product - Slag - ME Storage Bus



Configuration 8-6-2. Product - Slag - ME Interface

9. Phyto-Gro

The seventh stage of the production process involves producing Phyto-Gro. The following is an outline of the production process:

1 Crafters take Pulverized Charcoal, Niter, and Slag to produce Phyto-Gro.

2 Phyto-Gro is extracted from the Crafters and inserted into the Phyto-Gro buffer chest.

3 Phyto-Gro within the Phyto-Gro buffer chest is imported and stored in the AE production network.

Phyto-Gro is used in the following production stage(s):

- Rich Phyto-Gro
- Sap
- Sugar Cane/Potatoes

The following machinery is used during this production stage:

- Crafter - Ender IO

9.1. Description

Crafters are used to craft Phyto-Gro. Material is inserted directly into the Crafters using ME Export Buses with Capacity Card upgrades. This eliminates the need for three separate buffer chests to store the exporting materials.

9.2. Flow Charts

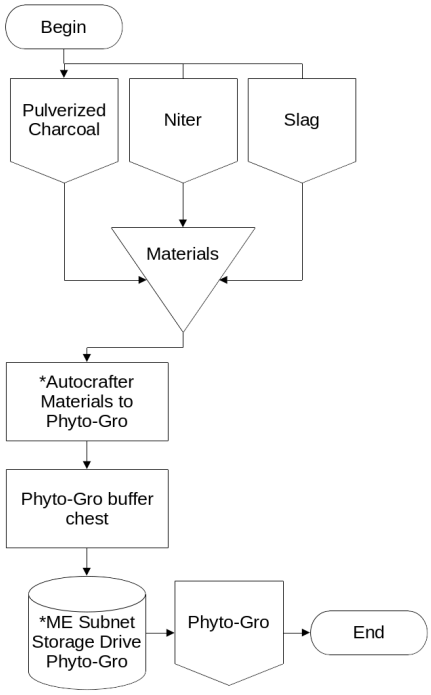
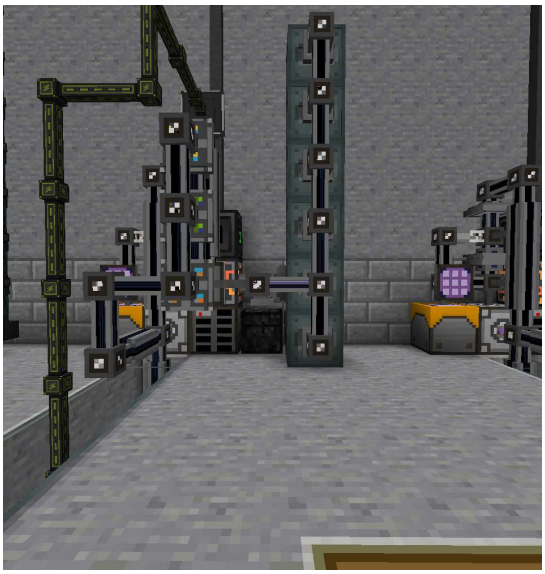


Figure 9-1. Phyto-Gro Production Diagram

9.3. Setup Photos

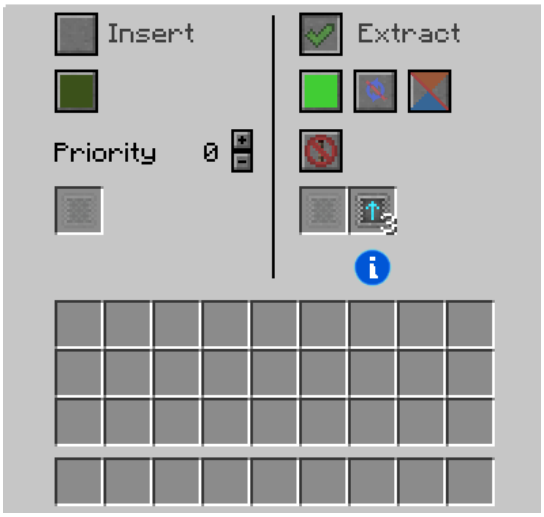


Photograph 9-1. Phyto-Gro production systems

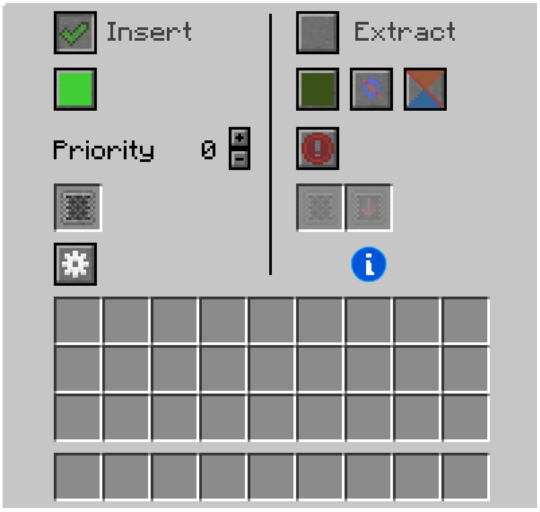
Photograph 9-2. Resource Provision Systems;P2P Tunnel (top) provides Pulverized Charcoal, P2P Tunnel (middle) provides Niter, P2P Tunnel (bottom) provides Slag.

Photograph 9-3. Phyto-Gro buffer chest

Configuration 9-1. Crafters Configuration

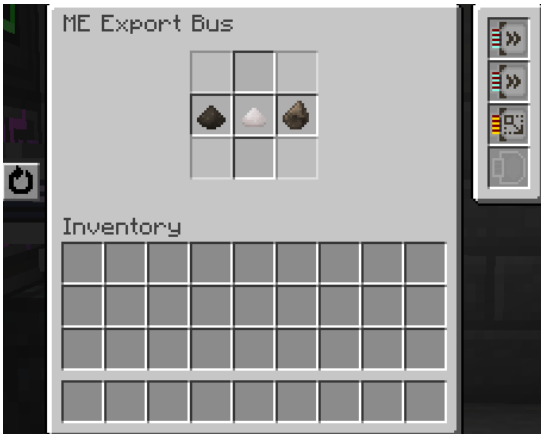


Configuration 9-2. Item Conduit configuration for Crafters.



Configuration 9-3-1. Item Conduit configuration for Phyto-Gro buffer chest.

Configuration 9-3-2. Item Conduit insert filter configuration for Phyto-Gro buffer chest.



Configuration 9-4. Crafters ME Export Bus configuration.

Configuration 9-5-1. Product - Phyto-Gro - ME Storage Bus

Configuration 9-5-2. Product - Phyto-Gro - ME Interface

10. Water

The eighth stage of the production process involves producing Water. The following is an outline of the production process:

1 Aqueous Accumulators pump Water and insert that Water into Water buffer drums.

2 Water in the Water buffer drums is imported and stored in the AE production network.

Water is used in the following production stage(s):

- Hootch
- Redstone-Growing
- Sap
- Sugar Cane/Potatoes

The following machinery is used during this production stage:

- Aqueous Accumulator - Thermal Expansion

10.1. Description

Aqueous Accumulators are used to generate Water during this production stage. Water is used for multiple processes throughout the production process, as such it is crucial that enough Water be supplied to the various processes. To ensure that a sufficient amount of Water is supplied, make sure there is an appropriate amount of: Aqueous Accumulators to produce the required amount of water, Fluid Import Buses to import the required amount of Water into the AE production network, and P2P Tunnel connections and the associated ME Interfaces which will allow for the extraction of Water from the AE production network.

10.2. Flow Charts

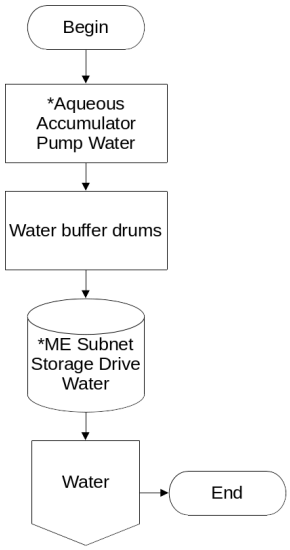
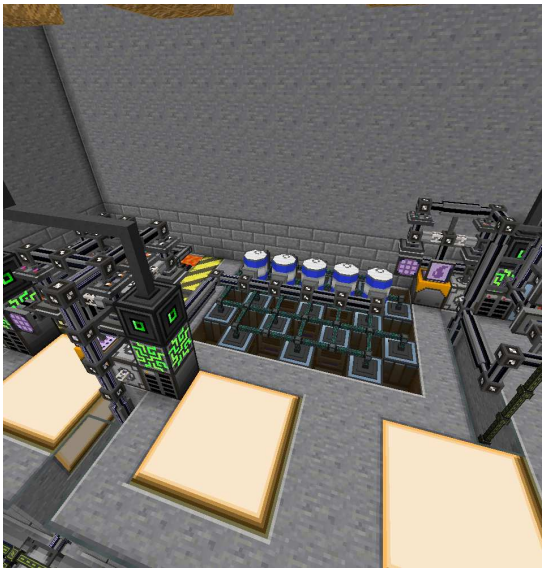
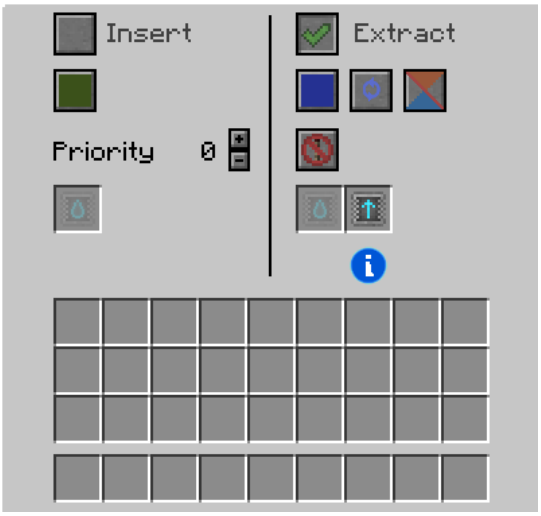


Figure 10-1. Water Production Diagram

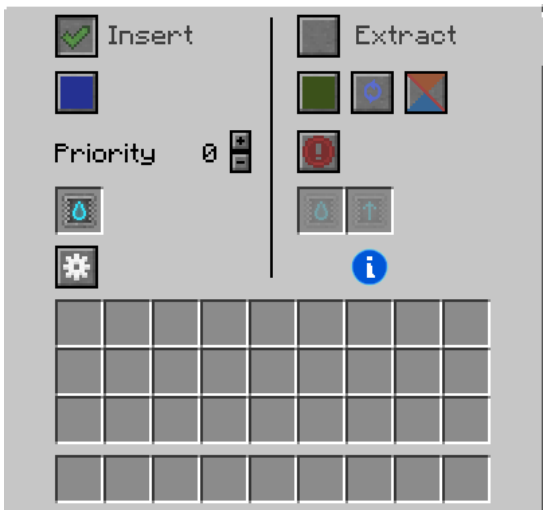
10.3. Setup Photos



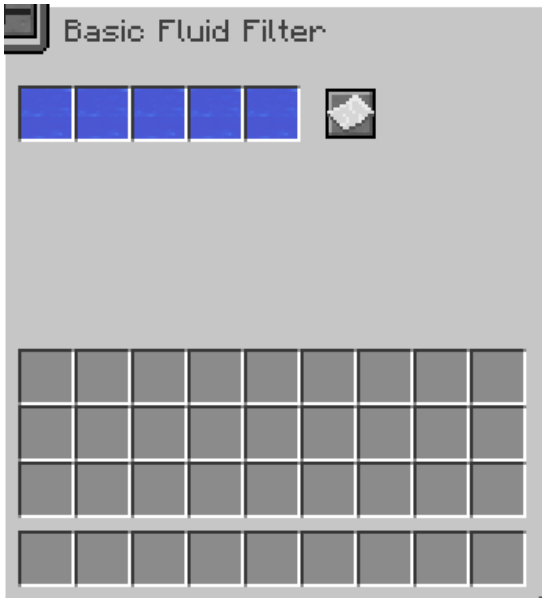
Photograph 10-1. Water production systems



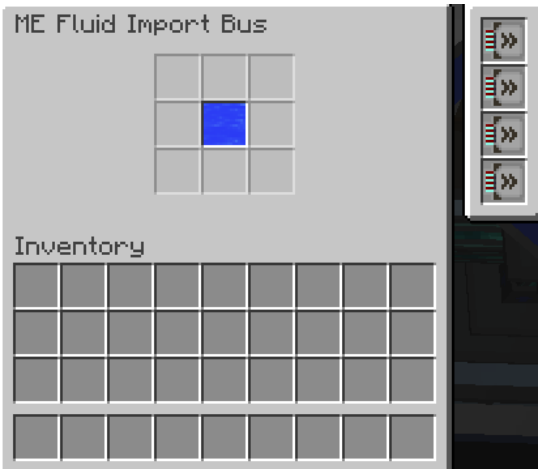
Configuration 10-1. Fluid Conduit configuration for Aqueous Accumulators.



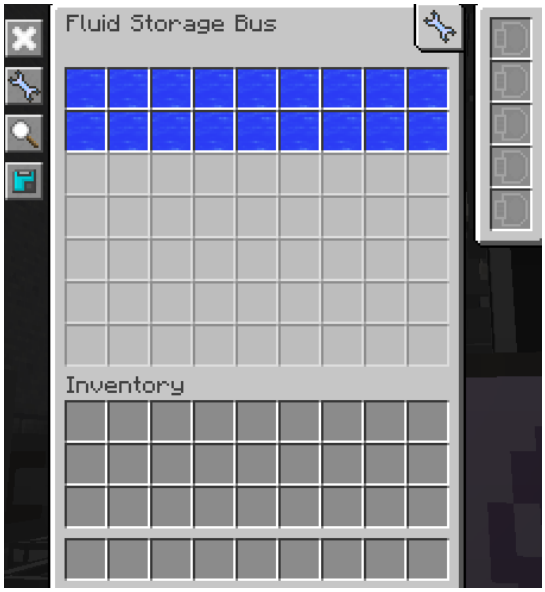
Configuration 10-2-1. Fluid Conduit configuration for Water buffer drums.



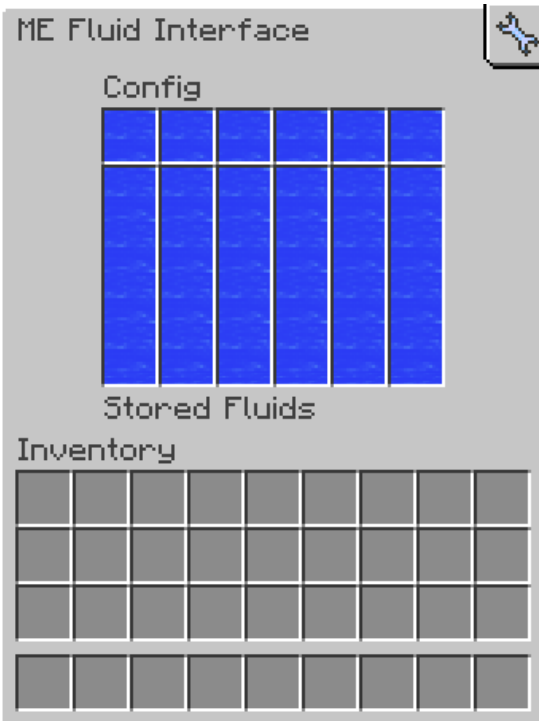
Configuration 10-2-2. Fluid Conduit insert filter configuration for Water buffer drums.



Configuration 10-3. Water ME Import Bus configuration.



Configuration 10-4-1. Product - Water - ME Fluid Storage Bus



Configuration 10-4-2. Product - Water - ME Fluid Interface

11. Sugar Cane and Potatoes

The ninth stage of the production process involves producing Sugar Cane and Potatoes. The following is an outline of the production process:

1 Phytogenic Insolators take Phyto-Gro and Water to produce Sugar Cane and Potatoes, the by-product of Potato production is Poisonous Potatoes. A single Sugar Cane and Potato are placed inside their respective Phytogenic Insolators.

2 Poisonous Potatoes are inserted into a Nullifier.

3 Sugar Cane and Potatoes are inserted into their appropriate buffer chests.

4 Sugar Cane and Potatoes within their buffer chests are imported and stored in the AE production network.

Sugar Cane is used in the following production stage(s):

- Sugar

Potatoes are used in the following production stage(s):

- Hootch

The following machinery is used during this production stage:

- Nullifier - Thermal Expansion
- Phytogenic Insolator - Thermal Expansion

11.1. Description

Sugar Cane and Potatoes are grown using Phytogenic Insolators. These Phytogenic Insolators are separated into two columns, the first column producing Sugar Cane and the second column producing potatoes. Each Phytogenic Insolator is equipped with: the Monoculture Cycle specialization, one (1) Auxiliary Reception Coil, and two (2) Nutrient Recovery augments. These augments ensure there is a balance between speed, efficiency, and practicality.

11.2. Flow Charts

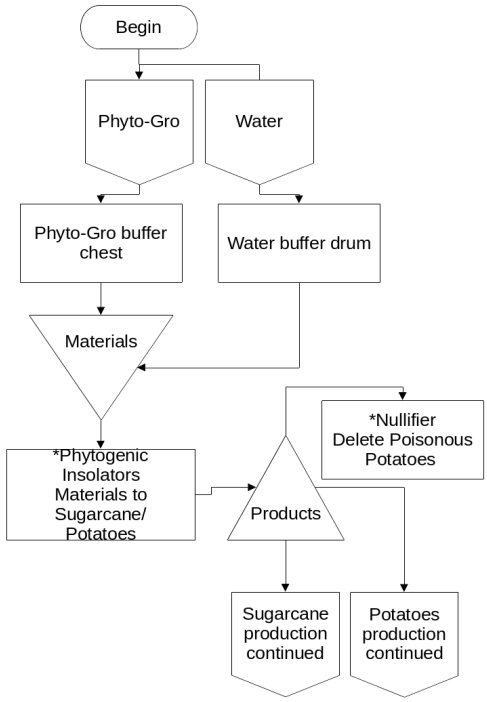


Figure 11-1. Sugar Cane and Potatoes Production Diagram

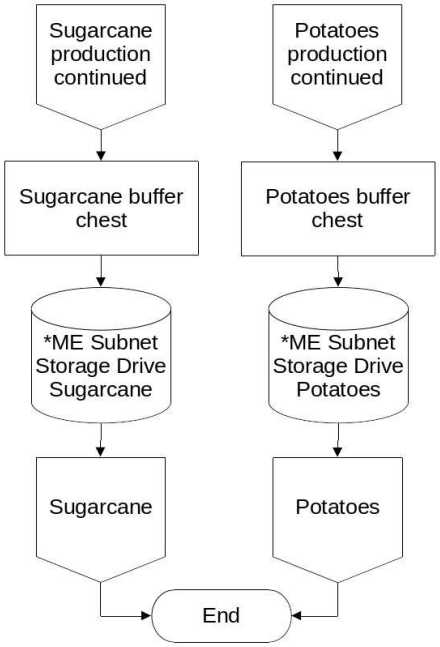
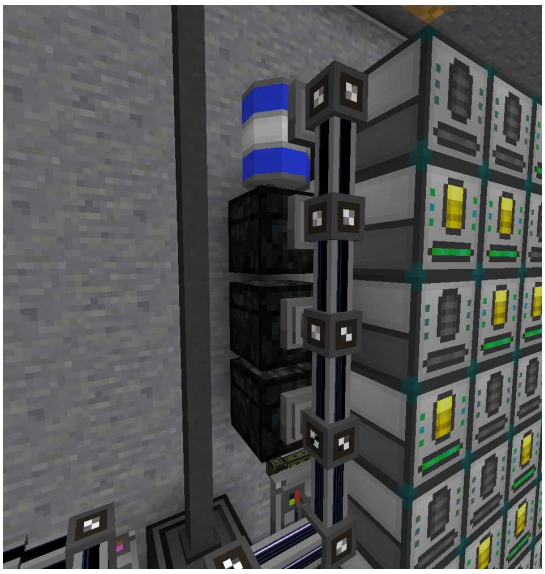


Figure 11-2. Sugar Cane and Potatoes Production Diagram continued

11.3. Setup Photos

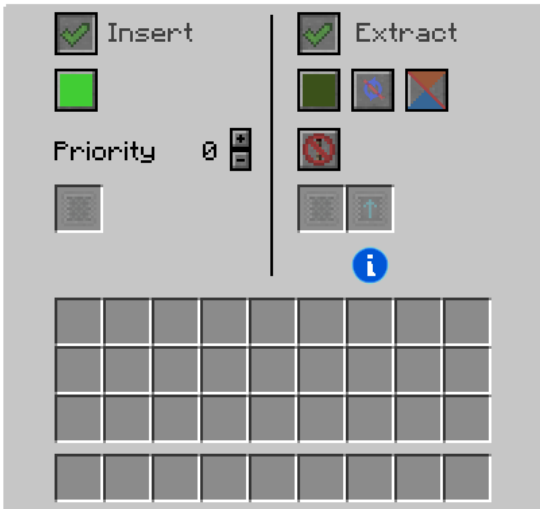
Photograph 11-1. Sugar Cane and Potatoes production systems

Photograph 11-2. Resource Provision Systems; P2P Tunnel (top) provides Water, P2P Tunnel (bottom) provides Phyto-Gro.

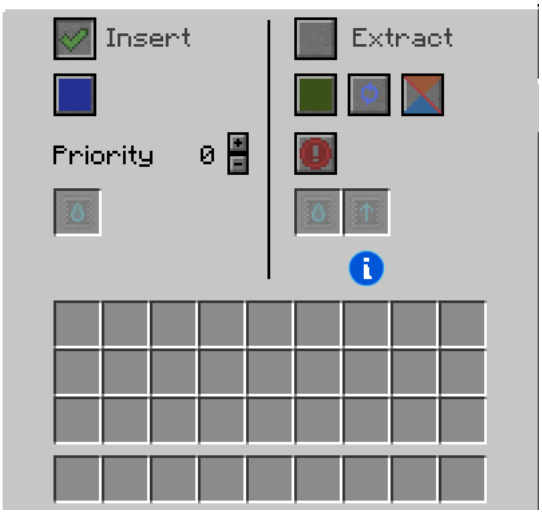


Photograph 11-3. Water buffer drum (top), Phyto-Gro buffer chest (second from top), Potatoes buffer chest (third from top), Sugar Cane buffer chest (fourth from top).

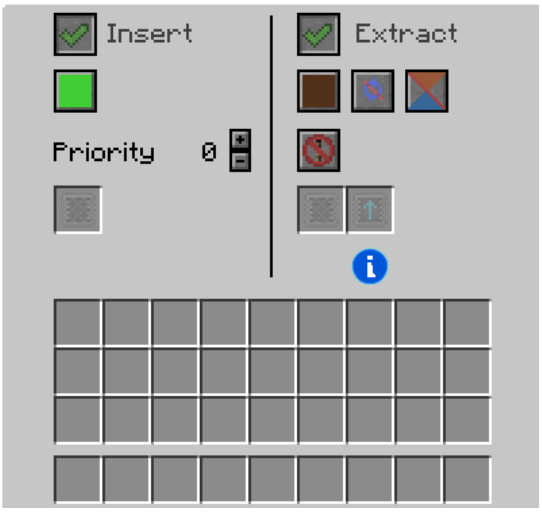
Configuration 11-1. Phytogenic Insolators augment configuration.



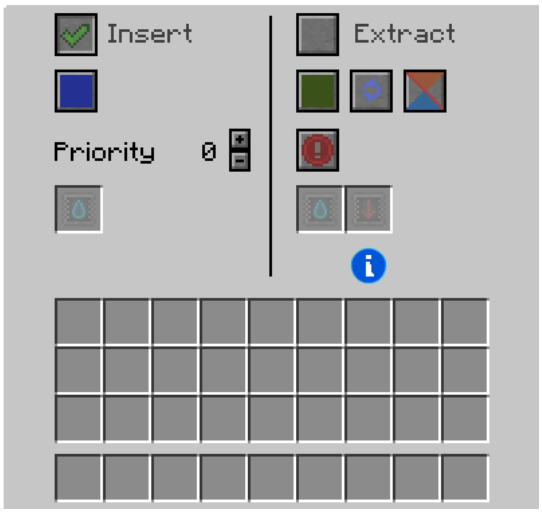
Configuration 11-2-1. Item Conduit configuration for Sugar Cane Phytogenic Insolators.



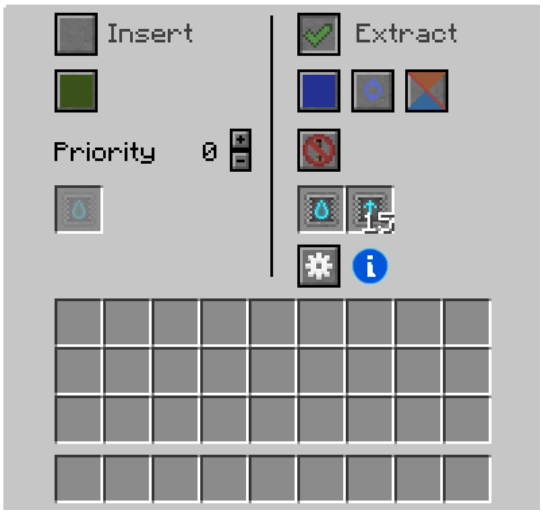
Configuration 11-2-2. Fluid Conduit configuration for Sugar Cane Phytogenic Insolators.



Configuration 11-3-1. Item Conduit configuration for Potatoes Phytogenic Insolators.

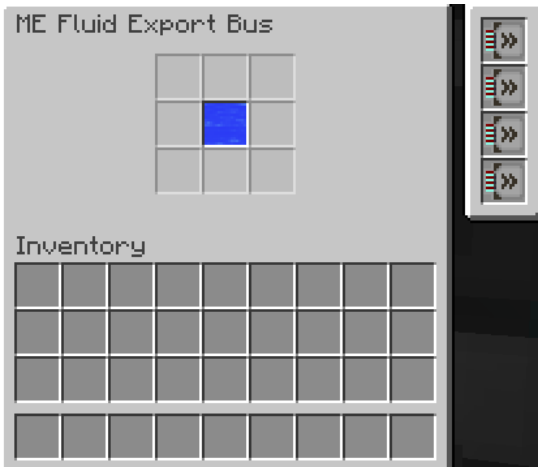


Configuration 11-3-2. Fluid Conduit configuration for Potatoes Phytogenic Insolators.

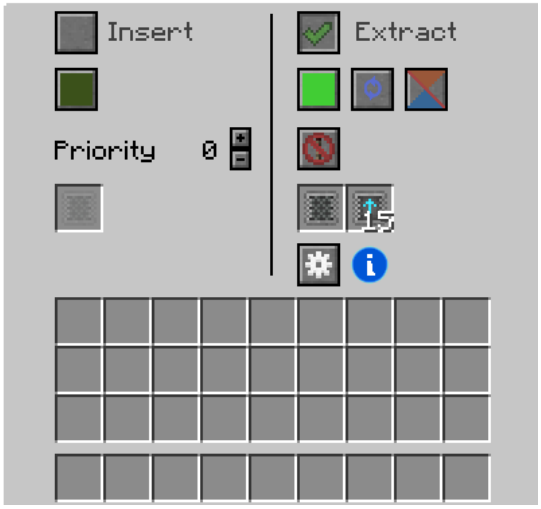


Configuration 11-4-1. Fluid Conduit configuration for Water buffer drum.

Configuration 11-4-2. Fluid Conduit extract filter configuration for Water buffer drum.



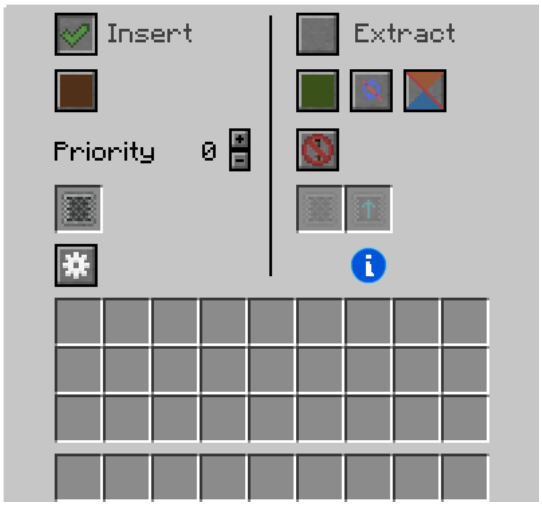
Configuration 11-4-3. ME Fluid Export Bus configuration for Water buffer drum.



Configuration 11-5-1. Item Conduit configuration for Phyto-Gro buffer chest.

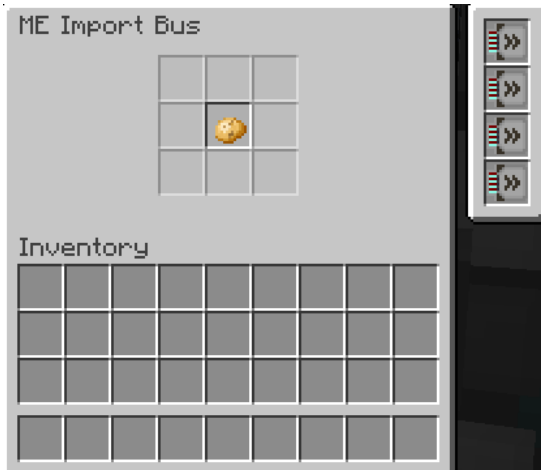
Configuration 11-5-2. Item Conduit extract filter configuration for Phyto-Gro buffer chest.

Configuration 11-5-3. ME Export Bus for Phyto-Gro buffer chest.

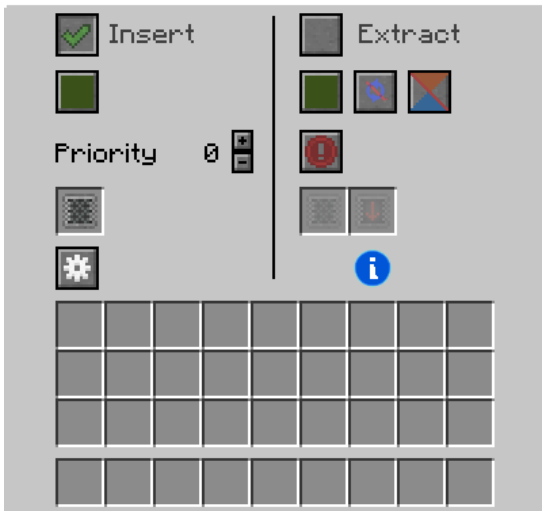


Configuration 11-6-1. Item Conduit configuration for Potatoes buffer chest.

Configuration 11-6-2. Item Conduit insert filter configuration for Potatoes buffer chest.

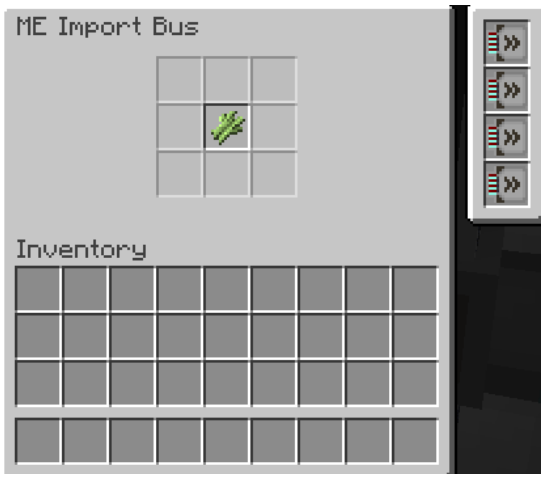


Configuration 11-6-3. ME Import Bus for Potatoes buffer chest.

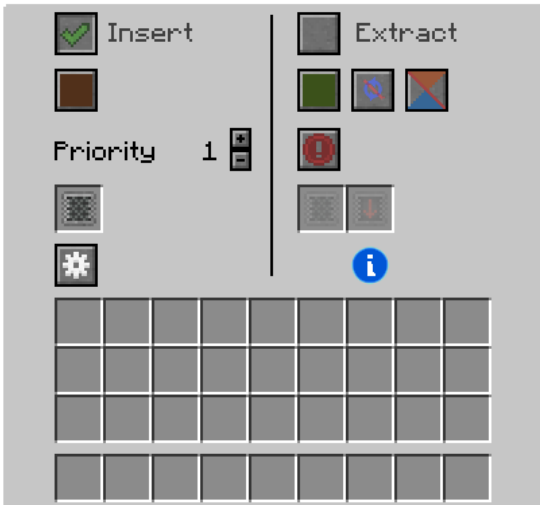


Configuration 11-7-1. Item Conduit configuration for Sugar Cane buffer chest.

Configuration 11-7-2. Item Conduit insert filter configuration for Sugar Cane buffer chest.

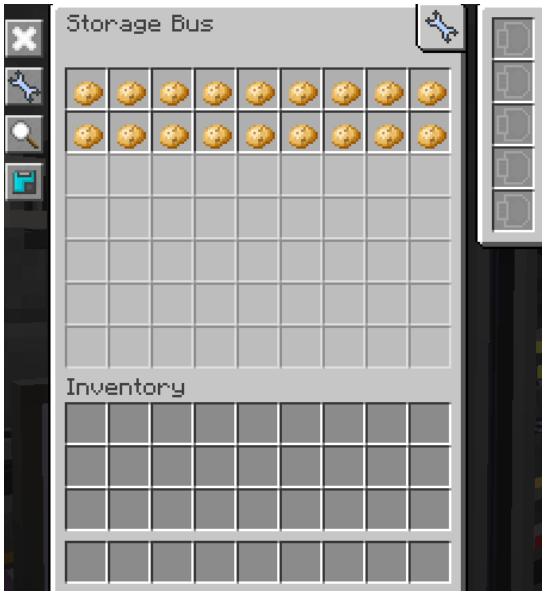


Configuration 11-7-3. ME Import Bus configuration for Sugar Cane buffer chest.

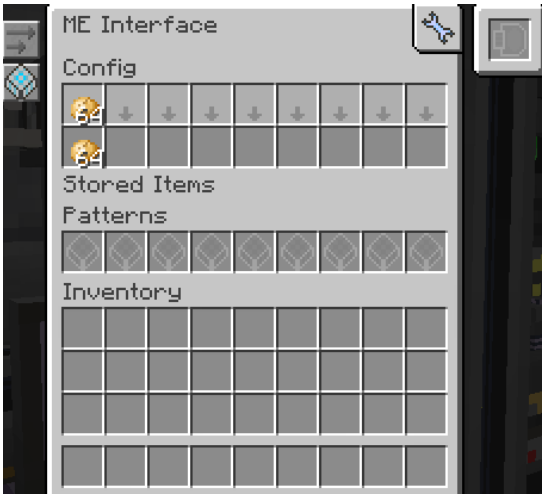


Configuration 11-8-1. Item Conduit configuration for Nullifier.

Configuration 11-8-2. Item Conduit insert filter configuration for Nullifier.



Configuration 11-9-1. Product - Potatoes - ME Storage Bus



Configuration 11-9-2. Product - Potatoes - ME Interface

Configuration 11-10-1. Product - Sugar Cane - ME Storage Bus

Configuration 11-10-2. Product - Sugar Cane - ME Interface

12. Sugar

The tenth stage of the production process involves producing Sugar. The following is an outline of the production process:

1 Centrifugal Separators take Sugar Cane and turn it into Sugar, a by-product of this process is Water.

2 Water is inserted into a Nullifier.

3 Sugar is extracted from the Centrifugal Separators and inserted into the Sugar buffer chest.

4 Sugar within the Sugar buffer chest is imported and stored in the AE production network.

Sugar is used in the following production stage(s):

- Hootch

The following machinery is used during this production stage:

- Centrifugal Separator - Thermal Expansion
- Nullifier - Thermal Foundation

12.1. Description

Centrifugal Separators are used to centrifuge Sugar Cane into Sugar. One (1) Sugar Cane is inserted into the Centrifugal Separators which is turned into two (2) Sugar. During this process Water is produced as a by-product, which is then deleted in a Nullifier.

12.2. Flow Charts

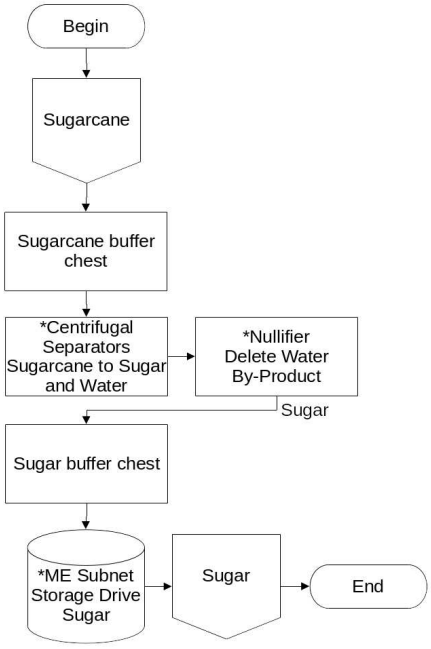
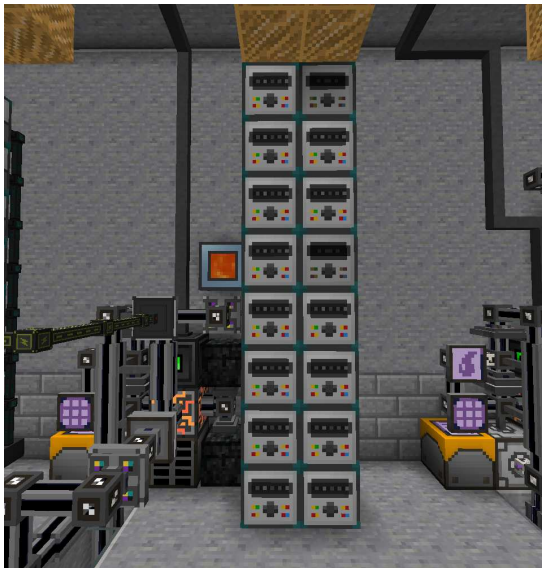
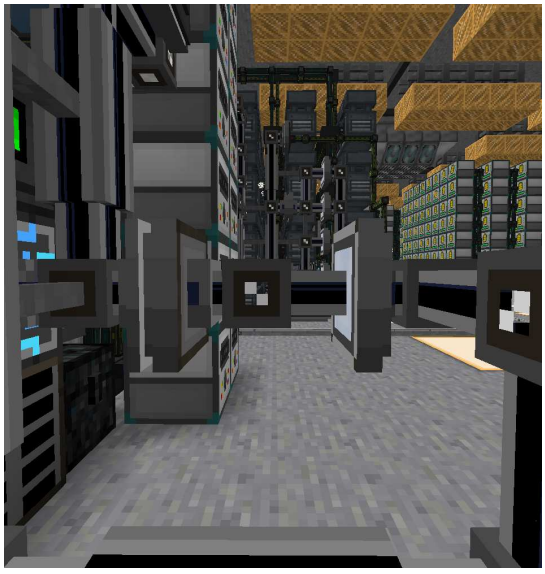


Figure 12-1. Sugar Production Diagram

12.3. Setup Photos



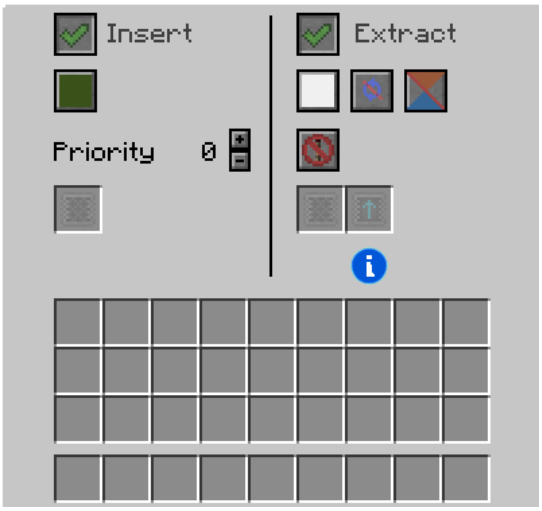
Photograph 12-1. Sugar production systems



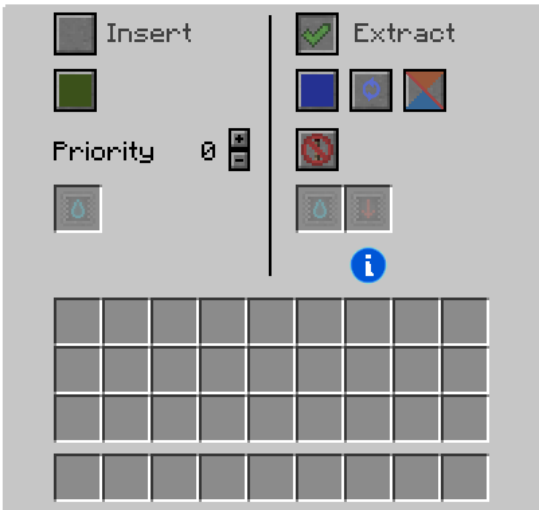
Photograph 12-2. Resource Provision Systems; P2P Tunnel (right) provides Sugar Cane.

Photograph 12-3. Sugar Cane buffer chest (top), and Sugar buffer chest (bottom).

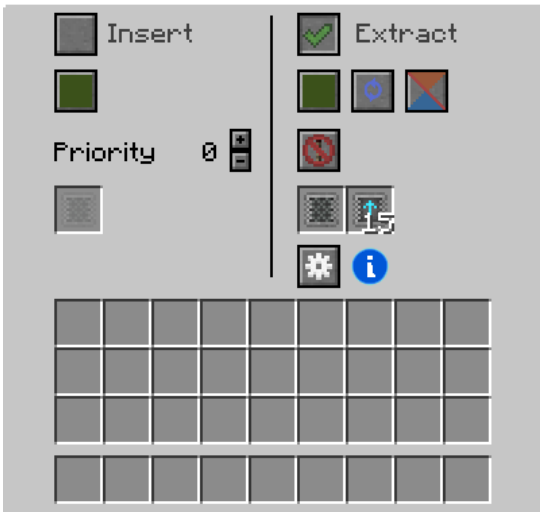
Configuration 12-1-1. Centrifugal Separators augment configuration.



Configuration 12-2-1. Item Conduit configuration for Centrifugal Separators.



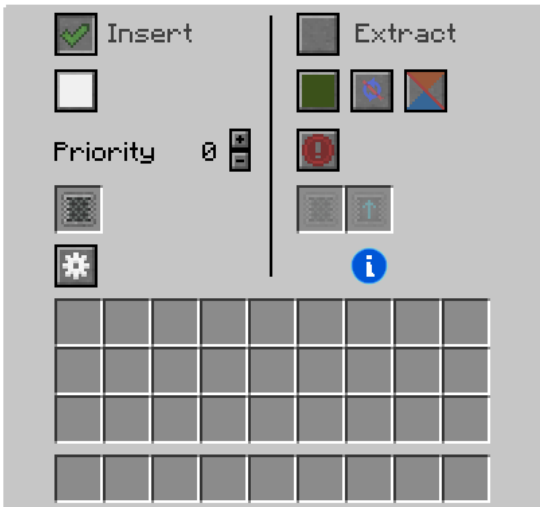
Configuration 12-2-2. Fluid Conduit configuration for Centrifugal Separators.



Configuration 12-3-1. Item Conduit configuration for Sugar Cane buffer chest.

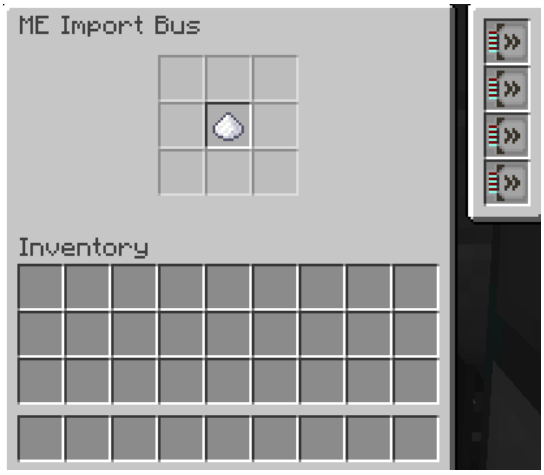
Configuration 12-3-2. Item Conduit extract filter configuration for Sugar Cane buffer chest.

Configuration 12-3-3. ME Export Bus configuration for Sugar Cane buffer chest.

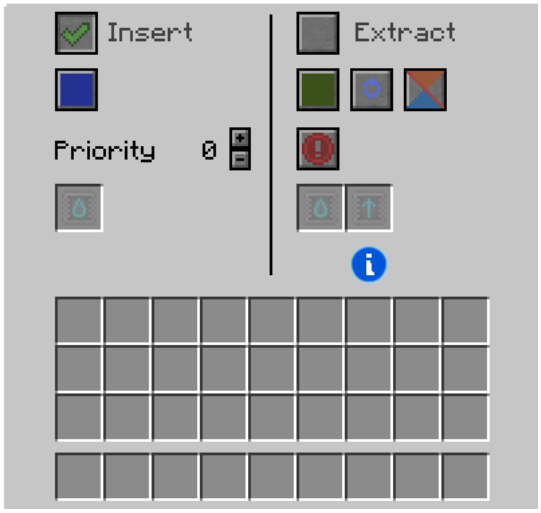


Configuration 12-4-1. Item Conduit configuration for Sugar buffer chest.

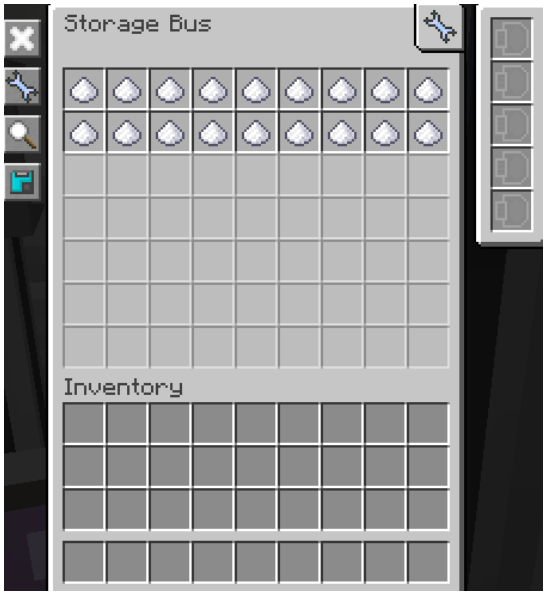
Configuration 12-4-2. Item Conduit insert filter configuration for Sugar buffer chest.



Configuration 12-4-3. ME Import Bus configuration for Sugar buffer chest.



Configuration 12-5. Fluid Conduit configuration for Nullifier.



Configuration 12-6-1. Product - Sugar - ME Storage Bus

Configuration 12-6-2. Product - Sugar - ME Interface

13. Sap

The eleventh stage of the production process involves producing Sap. The following is an outline of the production process:

1 Phytogenic Insolators grow Dark Oak Logs using Water and Phyto-Gro. A single Dark Oak Sapling is present within each Phytogenic Insolator.

2 Dark Oak Logs are extracted from the Phytogenic Insolators and inserted into the Dark Oak Logs buffer chest.

3 Dark Oak Logs from the Dark Oak Logs buffer chest are inserted into Sawmills.

4 An ME Fluid Level Emitter checks the level of Sap currently stored within the AE production network. If the amount of Sap is less-than 520,192,000 Millibuckets (mB), then a redstone signal is emitted. A Redstone Conduit transports this signal into a Processor on the purple redstone channel.

5 The Processor checks for a redstone input signal (provided by the Redstone Conduit on the purple redstone channel) every 600 ticks (30 seconds). If a signal is present, the Processor emits a redstone signal on the red redstone channel, if no signal is present no signal is emitted.

6 The redstone signal on the red redstone channel enables/disables the Sawmills. If a signal is present the Sawmills are disabled, if no redstone signal the Sawmills are enabled.

7 Sawmills create Sap along with other by-products (Dark Oak Planks, Sawdust).

8 By-products from the previous step are inserted into a Nullifier.

9 Sap from step 7 is inserted into the Sap buffer drum.

10 Sap in the Sap buffer drum is imported and stored in the AE production network.

Sap is used in the following production stage(s):

- Rich Phyto-Gro

The following machinery is used during this production stage:

- Nullifier - Thermal Expansion
- Phytogenic Insolator - Thermal Expansion
- Processor - RFTools Control
- Sawmill - Thermal Expansion

13.1. Description

Sap is produced by the Sawmills at 20mb per-operation when using Dark Oak Logs (may vary depending on modpack configuration). To do this, each Sawmill uses: one (1) Resin Funnel, and three (3) Auxiliary Reception Coil augments, as

shown in Configuration 13-4-1.

Because of the speed of the Sawmills, twice the amount of Phytogenic Insolators will need to be used to balance the Dark Oak Wood consumption/production. Each Phytogenic Insolator uses: one (1) Sapling Infuser, one (1) Monoculture Cycle, and two (2) Auxiliary Reception Coil augments, as shown in Configuration 13-3-1.

13.1.1. Sap Sawmills PLC

The Sap production stage uses a Processor to toggle on/off the Sawmills by providing a redstone signal on the Red redstone channel which outputs to the Sawmills. This redstone signal is transferred using Redstone Conduits, as shown in Photograph 13-4. The processor takes a redstone signal on the purple redstone channel as input. This input redstone signal is created by an ME Fluid Level Emitter which reads the level of Sap currently stored in the AE Network, if the amount of Sap falls below 520,192,000 mB then a redstone signal is emitted. The processor is programmed to check the redstone signal on the South side of the Processor every 600 ticks (30 seconds). If a redstone signal is present, then the Processor will enable the Sawmills, else the Sawmills will be disabled. To facilitate redstone control by the Processor, all of the Sawmills will have their Redstone Control setting set to 'Low' (active without signal). When the Processor disables the Sawmills, the Sap production stage is put into the STANDBY Operation State.

The reason why the STANDBY Operation State is used and not the REDUCED Operation State is because the Sawmills are only disabled when the AE production network has reached its maximum capacity of Sap. By disabling the Sawmills, the Phytogenic Insolators will fill up their internal inventories with Dark Oak Wood then cease processing until the Sawmills are re-enabled.

13.2. Operating State Advisory

What follows is a list of one or more Operation States that modify this production system's physical/logical behavior, along with the specific systems modified:

- STANDBY - When this production system is put into this state: all of the Sawmills are disabled via a redstone signal.

13.3. Flow Charts

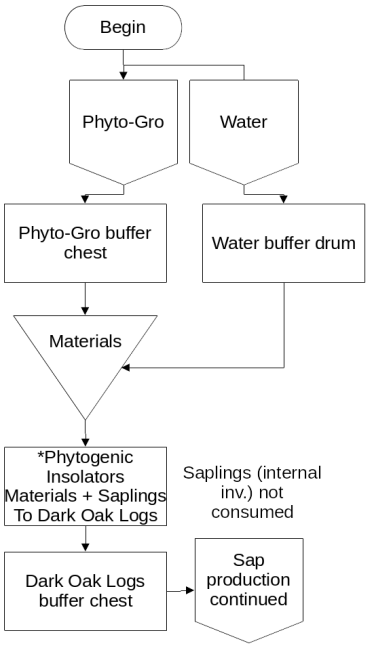


Figure 13-1. Sap Production Diagram

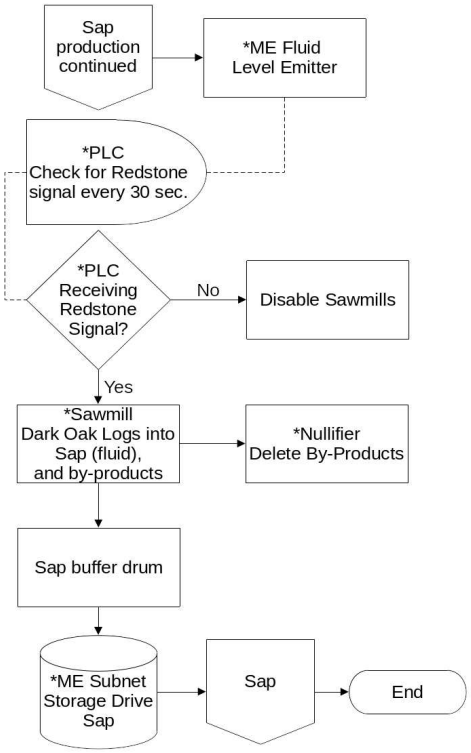
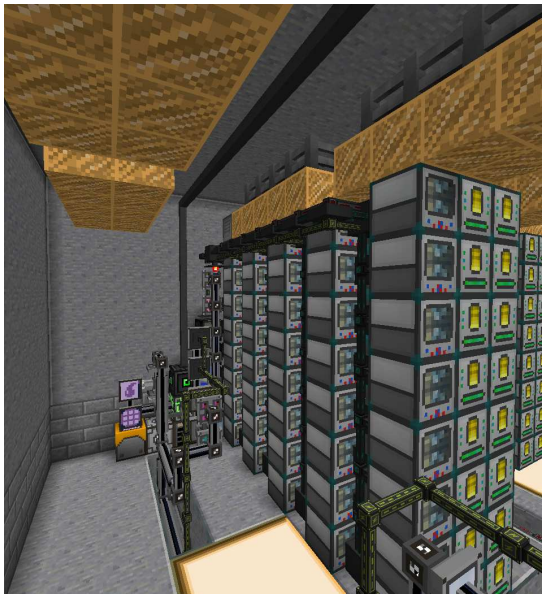
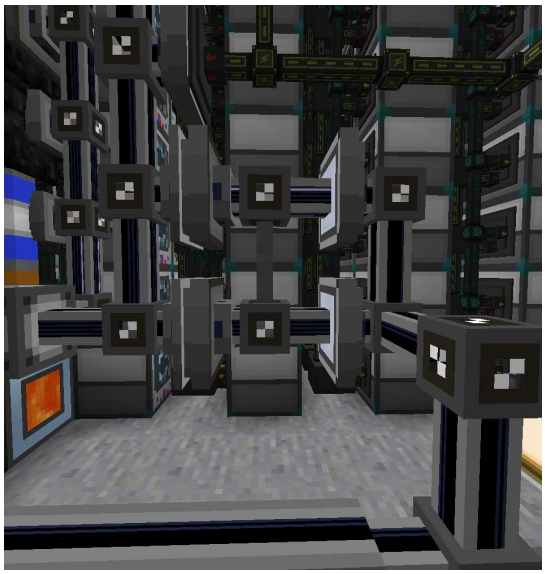


Figure 13-2. Sap Production Diagram continued

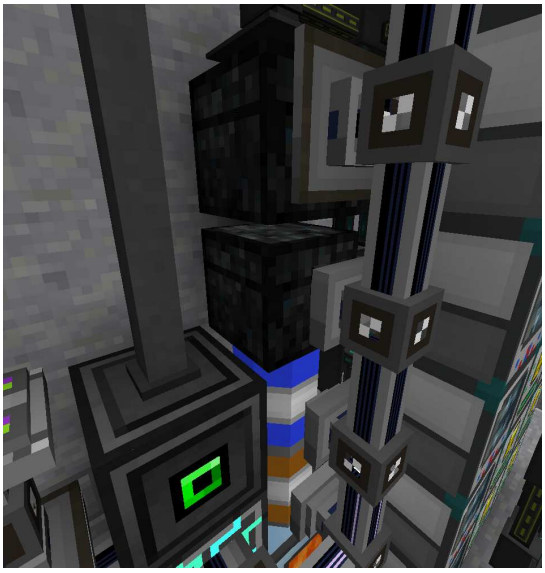
13.4. Setup Photos



Photograph 13-1. Sap Production Systems

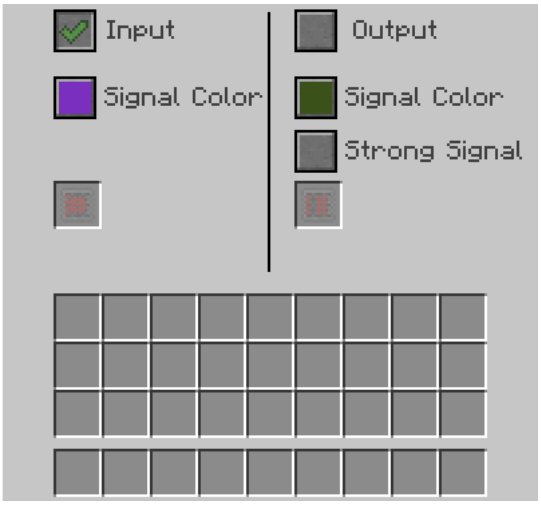


Photograph 13-2. Resource Provision Systems; P2P Tunnel (top) provides Water, P2P Tunnel (bottom) provides Phyto-Gro.

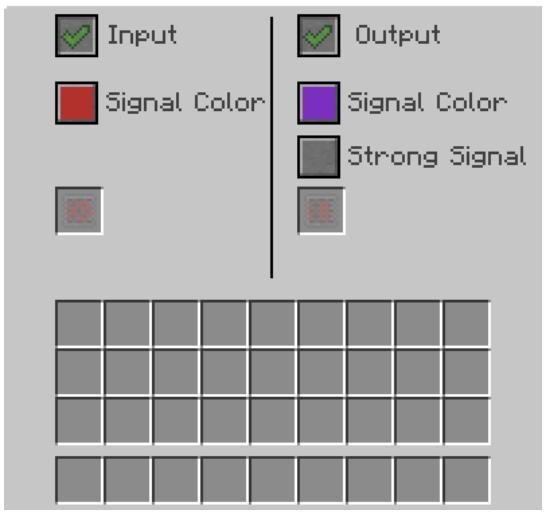


Photograph 13-3. Dark Oak Wood buffer chest (top), Phyto-Gro buffer chest (second from top), Water buffer drum (third from top), Sap buffer drum (fourth from top).

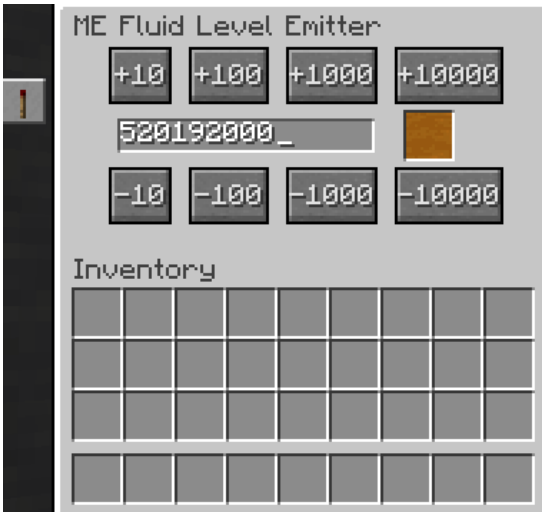
Photograph 13-4. Processor which controls the Sawmills (middle-right), and ME Level Emitter which provides a control signal for the Processor (middle).



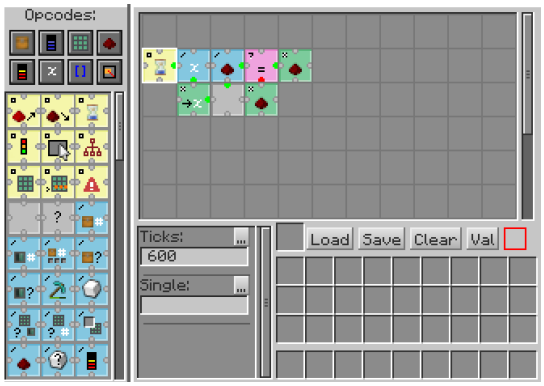
Configuration 13-1-1. Configuration for the Redstone Conduit which connects to the ME Fluid Level Emitter.



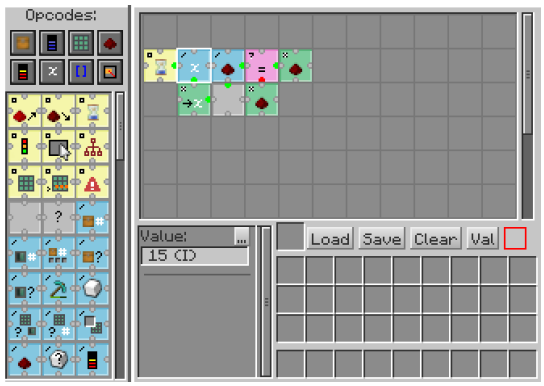
Configuration 13-1-2. Redstone Conduit configuration for the input/output Redstone Conduit connector on the Processor.



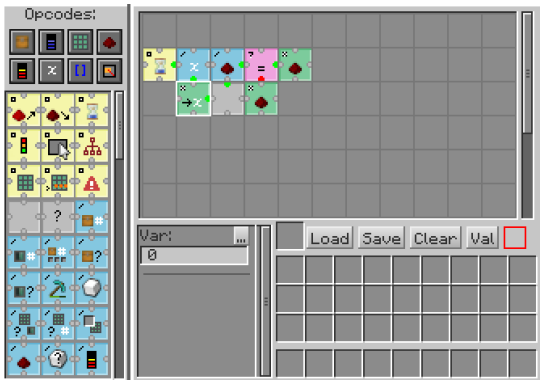
Configuration 13-1-3. ME Fluid Level Emitter configuration for Sap.



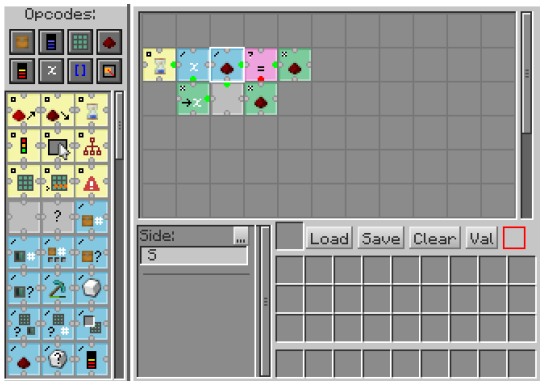
Configuration 13-2-1. Event: repeat, configured for 600 ticks (30 seconds).



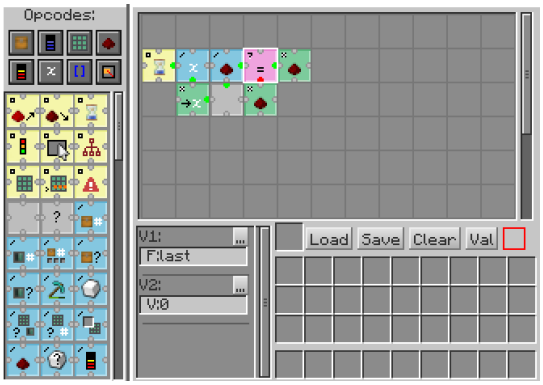
Configuration 13-2-2. Eval: number, configured for ’15’ (integer).



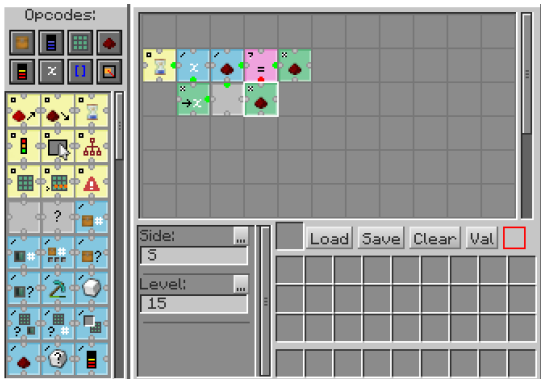
Configuration 13-2-3. Operation: set variable, configured for the previous Eval Opcode.



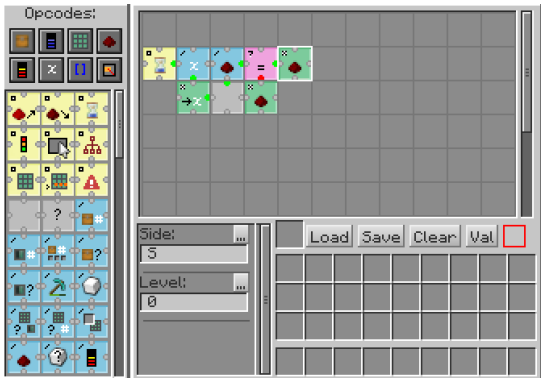
Configuration 13-2-4. Eval: read redstone, read redstone signal on South side of the Processor.



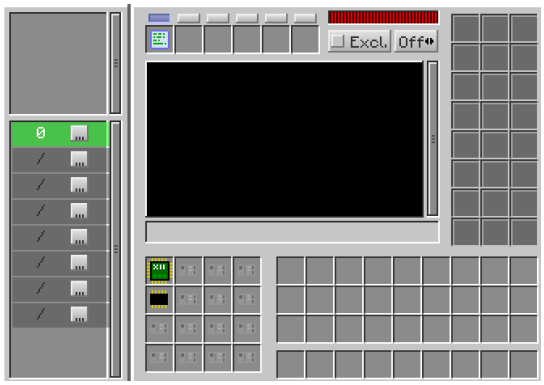
Configuration 13-2-5. Test: equality, if the last redstone signal read equals the value in variable 0 (V:0) set redstone signal output to '0' on South side, else set redstone signal output to '15' on South side.



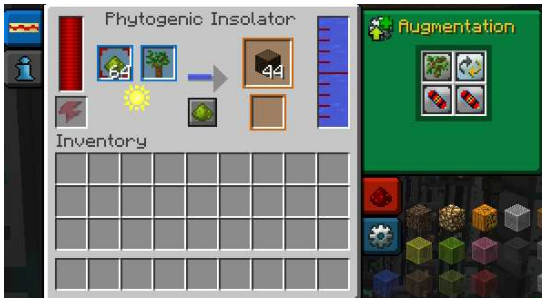
Configuration 13-2-6. Operation: set redstone, redstone signal output to '15' on South side if the 'Test: equality' statement is false.



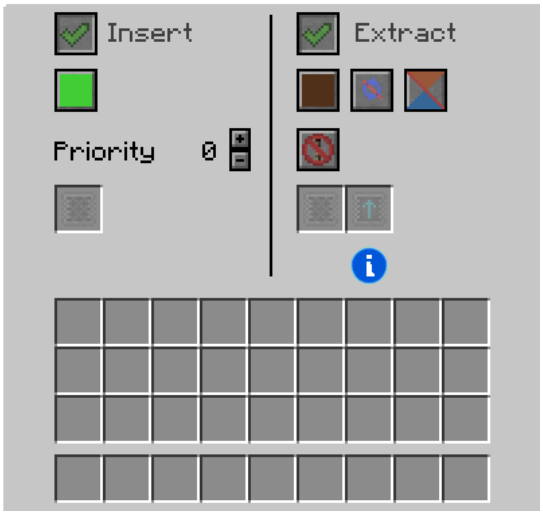
Configuration 13-2-7. Operation: set redstone, redstone signal output to '0' on South side if the 'Test: equality' statement is true.



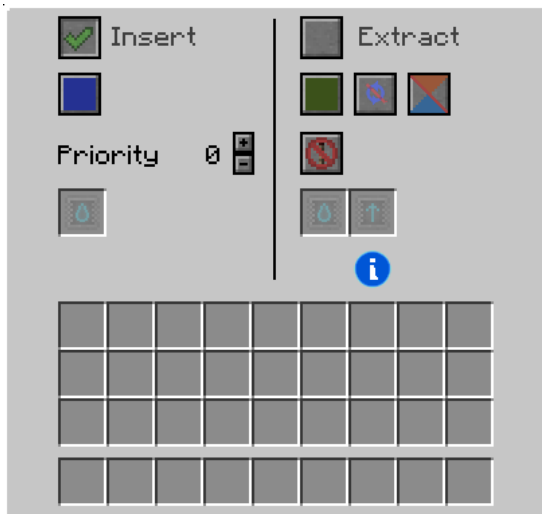
Configuration 13-2-8. Processor is equipped with: CPU Core EX2000 (1x), and RAM Chip 8E (1x). Variable 0 is allocated to program card.



Configuration 13-3-1. Phytogenic Insolators augment configuration.



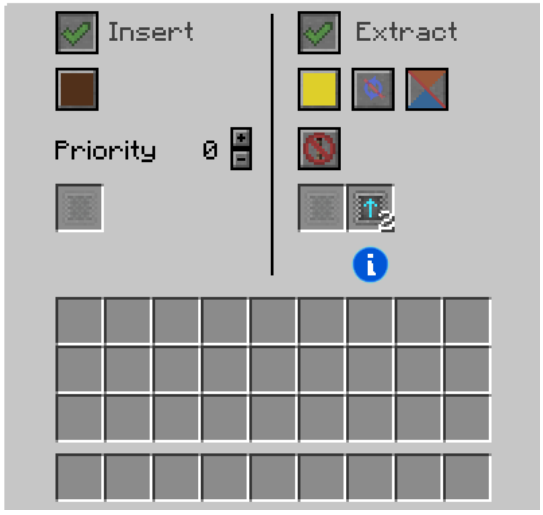
Configuration 13-3-2. Item Conduit configuration for Phytogenic Insolators.



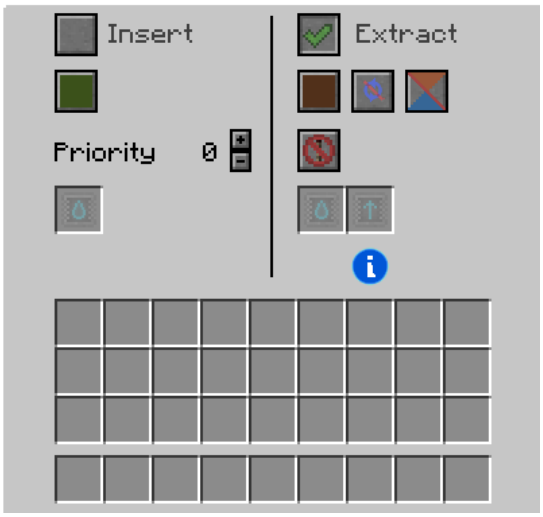
Configuration 13-3-3. Fluid Conduit configuration for Phytogenic Insolators.

Configuration 13-4-1. Sawmills augment configuration.

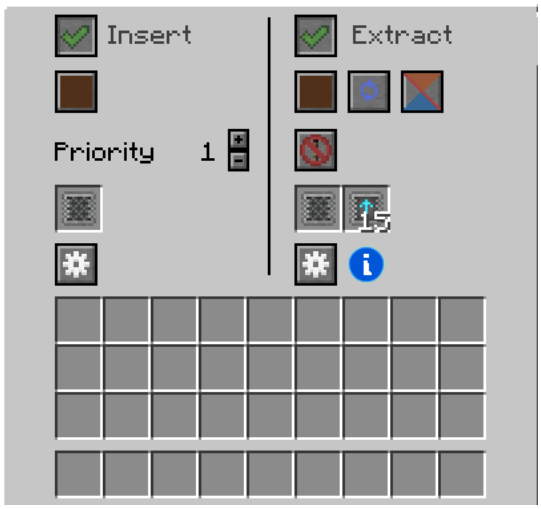
Configuration 13-4-2. Sawmills Redstone Control configuration.



Configuration 13-4-3. Item Conduit configuration for Sawmills.



Configuration 13-4-4. Fluid Conduit configuration for Sawmills.



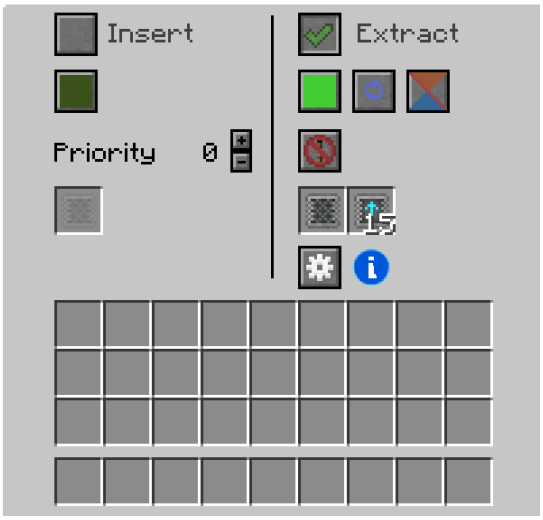
Configuration 13-5-1. Item Conduit configuration for Dark Oak Wood buffer chest.

Configuration 13-5-2. Item Conduit insert filter configuration for Dark Oak Wood buffer chest.

Configuration 13-5-3. Item Conduit extract filter configuration for Dark Oak Wood buffer chest.

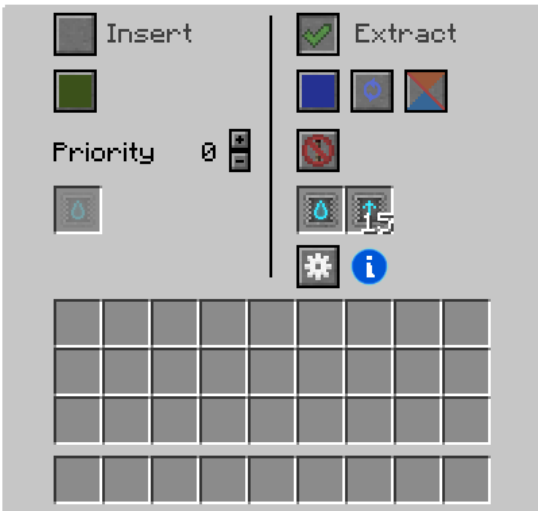
Configuration 13-5-4. ME Storage Bus configuration for Dark Oak Wood buffer chest.

Configuration 13-6-2. Item Conduit extract filter configuration for Phyto-Gro buffer chest.

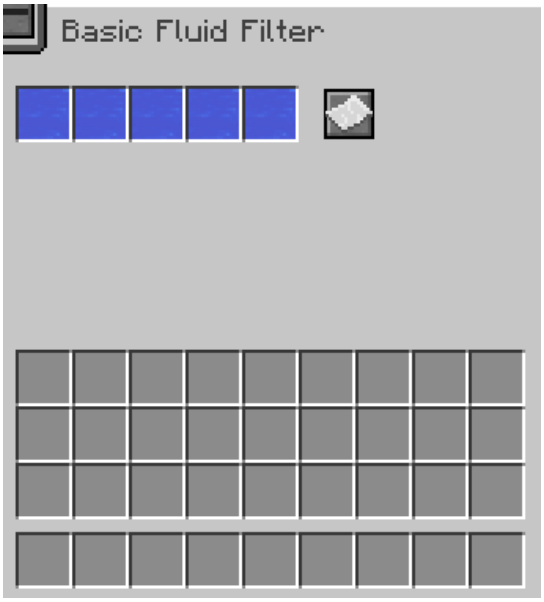


Configuration 13-6-1. Item Conduit configuration for Phyto-Gro buffer chest.

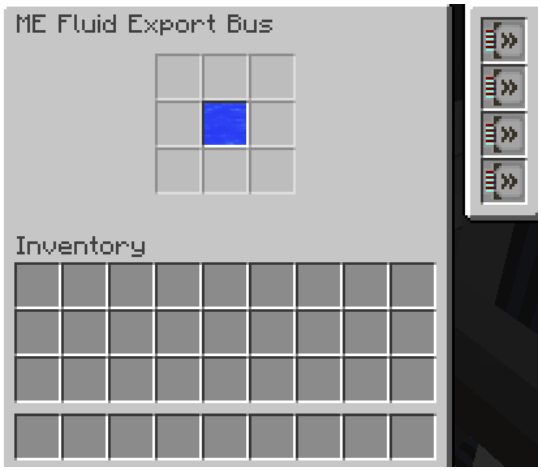
Configuration 13-6-3. ME Export Bus configuration for Phyto-Gro buffer chest.



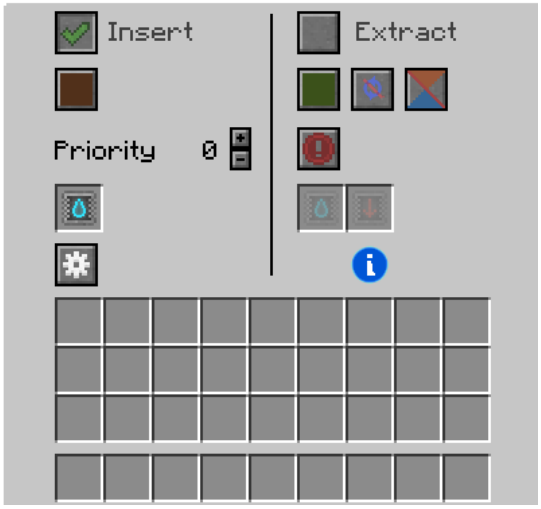
Configuration 13-7-1. Fluid Conduit configuration for Water buffer drum.



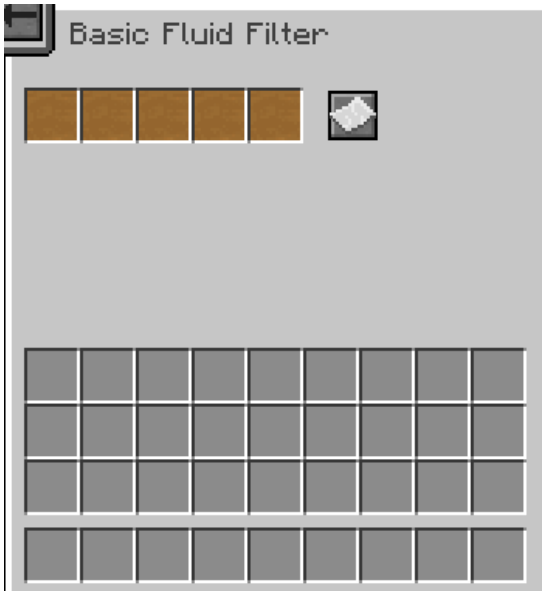
Configuration 13-7-2. Fluid Conduit extract filter configuration for Water buffer drum.



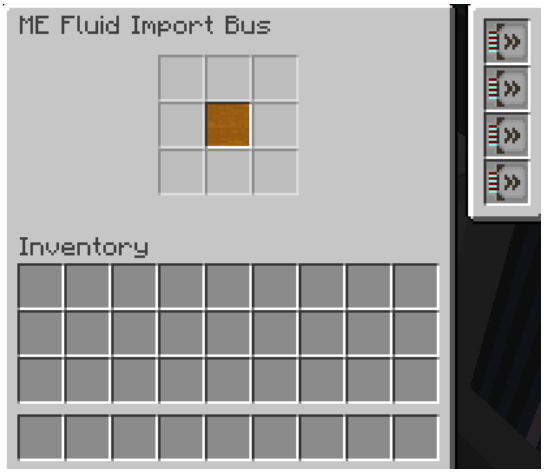
Configuration 13-7-3. ME Fluid Export Bus configuration for Water buffer drum.



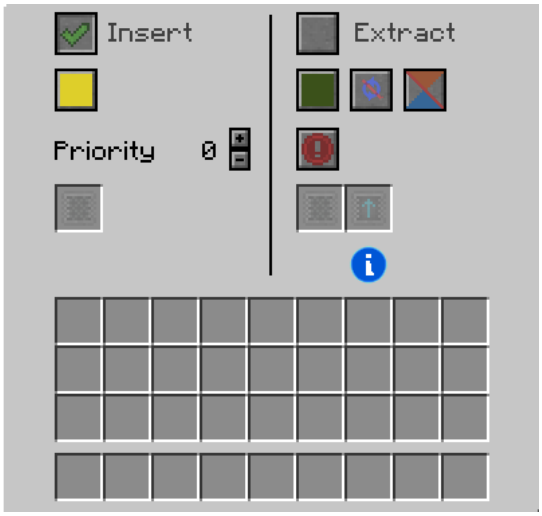
Configuration 13-8-1. Fluid Conduit configuration for Sap buffer drum.



Configuration 13-8-2. Fluid Conduit insert filter configuration for Sap buffer drum.

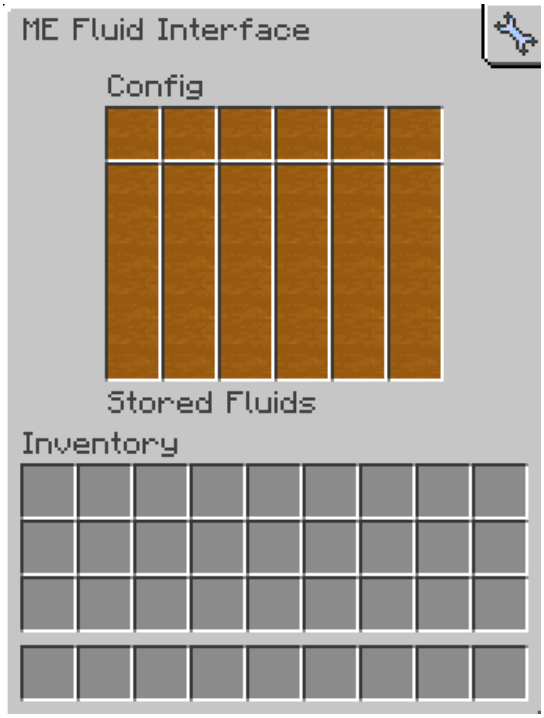


Configuration 13-8-3. ME Fluid Import Bus configuration for Sap buffer drum.



Configuration 13-9. Item Conduit configuration for Nullifier

Configuration 13-10-1. Product - Sap - ME Fluid Storage Bus



Configuration 13-10-2. Product - Sap - ME Fluid Interface

14. Rich Phyto-Gro

The twelfth stage of the production process involves producing Rich Phyto-Gro. The following is an outline of the production process:

1 Fluid Transposers take in Phyto-Gro and Sap to produce Rich Phyto-Gro.

2 Rich Phyto-Gro is inserted into the Rich Phyto-Gro buffer chest.

3 Rich Phyto-Gro within the Rich Phyto-Gro buffer chest is imported and stored in the AE production network.

Rich Phyto-Gro is used in the following production stage(s):

- Fluxed Phyto-Gro

The following machinery is used during this production stage:

- Fluid Transposer - Thermal Expansion

14.1. Description

Phyto-Gro and Sap are inserted into Fluid Transposers which then produce Rich Phyto-Gro using one (1) Phyto-Gro and 200mb of Sap. Each of the Fluid Transposers will use four (4) Auxiliary Reception Coil augments to increase processing speed.

14.2. Flow Charts

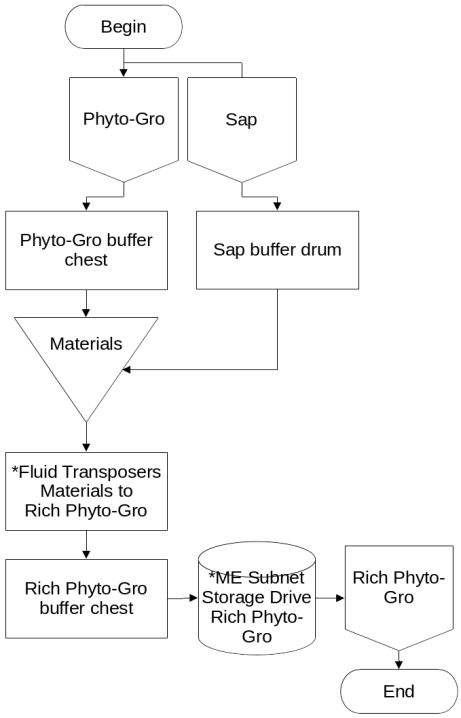
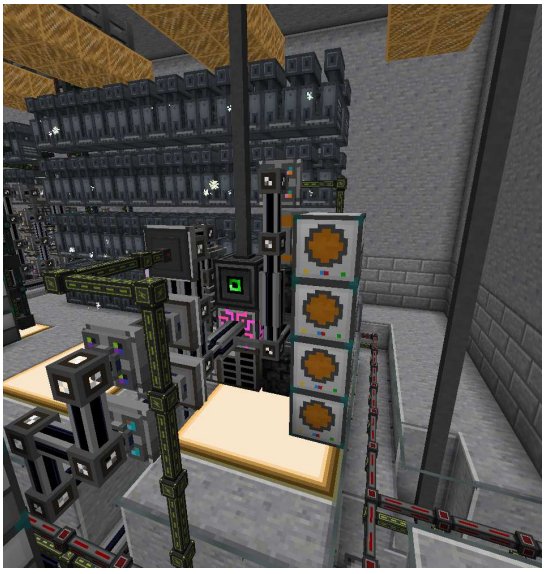
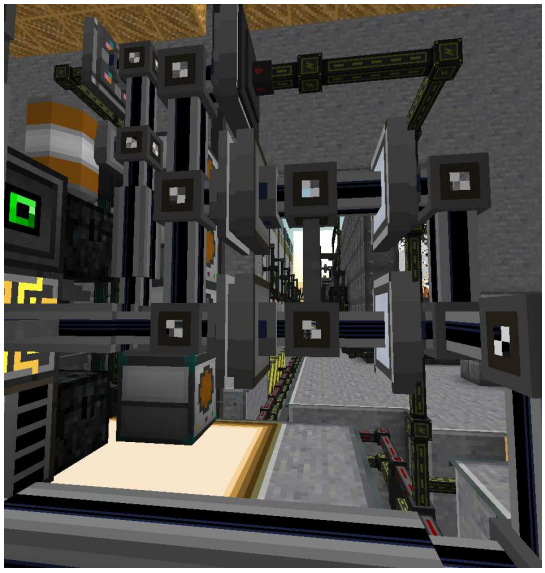


Figure 14-1. Rich Phyto-Gro Production Diagram

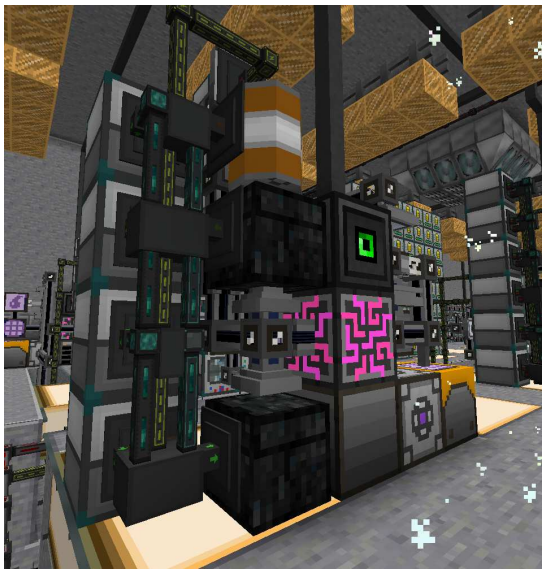
14.3. Setup Photos



Photograph 14-1. Rich Phyto-Gro production systems

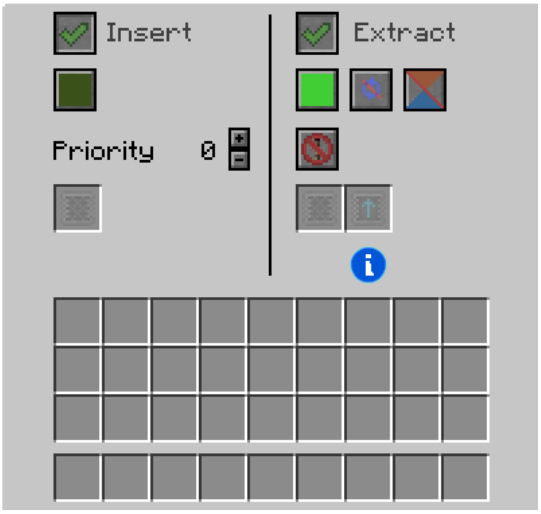


Photograph 14-2. Resource Provision Systems; P2P Tunnel (top) provides Sap, and P2P Tunnel (bottom) provides Phyto-Gro.

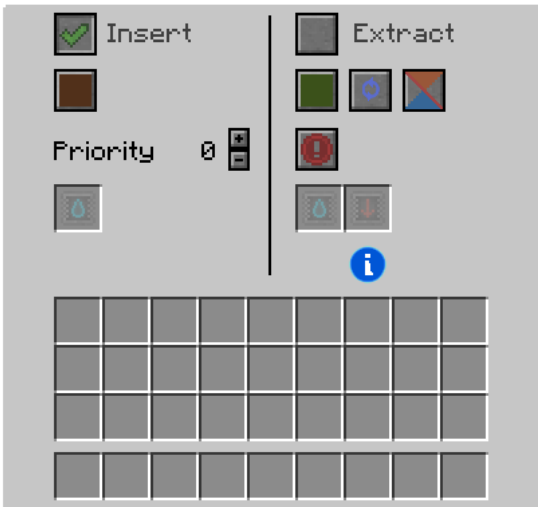


Photograph 14-3. Sap buffer drum (top), Phyto-Gro buffer chest (middle), and Rich Phyto-Gro buffer chest (bottom).

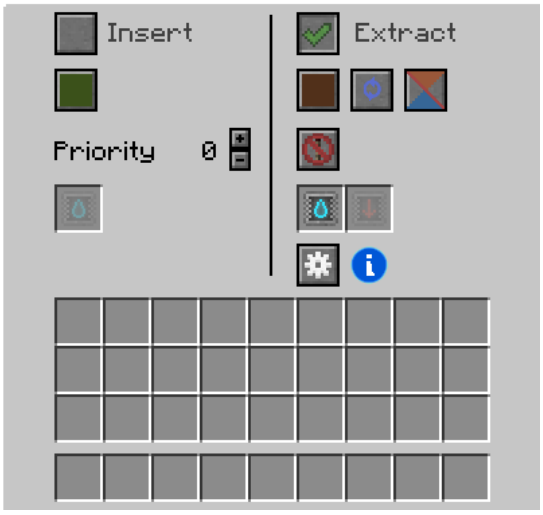
Configuration 14-1-1. Fluid Transposers augment configuration.



Configuration 14-1-2. Item Conduit configuration for Fluid Transposers.

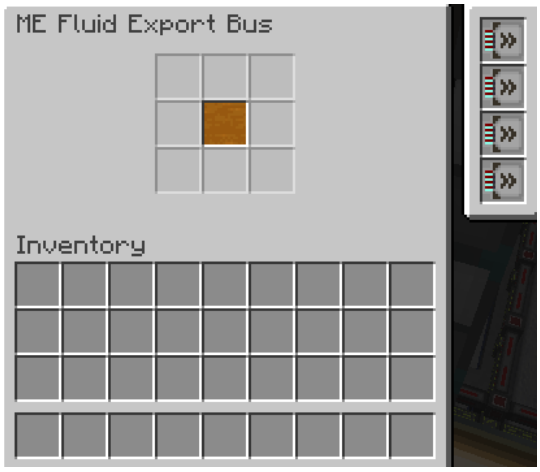


Configuration 14-1-3. Fluid Conduit configuration for Fluid Transposers.

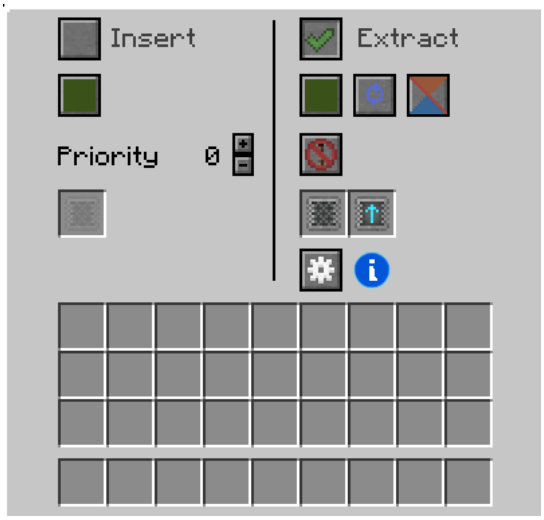


Configuration 14-2-1. Fluid Conduit configuration for Sap buffer drum.

Configuration 14-2-2. Fluid Conduit extract filter configuration for Sap buffer drum.



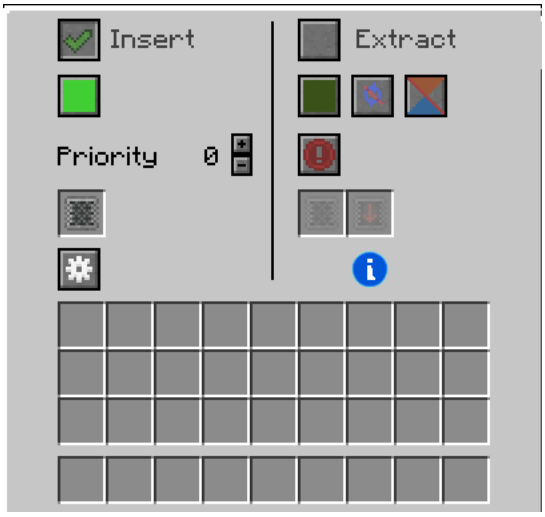
Configuration 14-2-3. ME Fluid Export Bus configuration for Sap buffer drum.



Configuration 14-3-1. Item Conduit configuration for Phyto-Gro buffer chest.

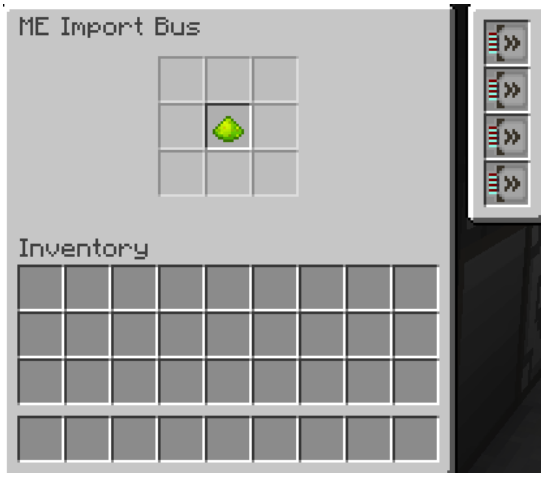
Configuration 14-3-2. Item Conduit extract filter configuration for Phyto-Gro buffer chest.

Configuration 14-3-3. ME Export Bus configuration for Phyto-Gro buffer chest.

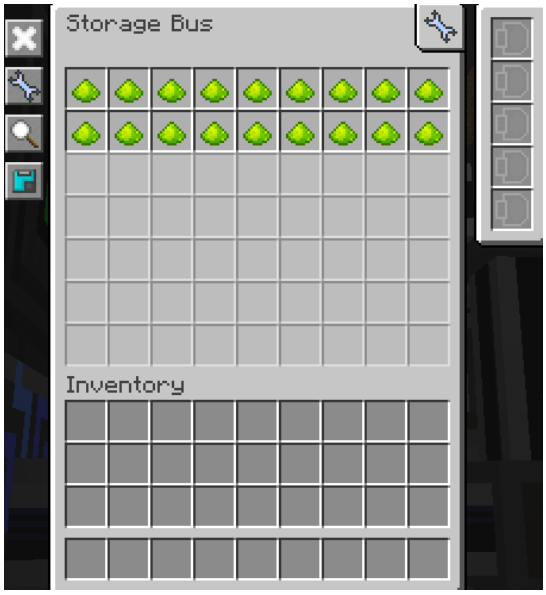


Configuration 14-4-1. Item Conduit configuration for Rich Phyto-Gro buffer chest.

Configuration 14-4-2. Item Conduit insert filter configuration for Rich Phyto-Gro buffer chest.



Configuration 14-4-3. ME Import Bus configuration for Rich Phyto-Gro buffer chest.



Configuration 14-5-1. Product - Rich Phyto-Gro - ME Storage Bus.

Configuration 14-5-2. Product - Rich Phyto-Gro - ME Interface.

15. Fluxed Phyto-Gro

The thirteenth stage of the production process involves producing Fluxed Phyto-Gro. The following is an outline of the production process:

1 Energetic Infusers take Rich Phyto-Gro and energize it into Fluxed Phyto-Gro.

2 Fluxed Phyto-Gro is inserted into the Fluxed Phyto-Gro buffer chest.

3 Fluxed Phyto-Gro within the Fluxed Phyto-Gro buffer chest is imported and stored in the AE production network.

Fluxed Phyto-Gro is used in the following production stage(s):

- Redstone-Growing

The following machinery is used during this production stage:

- Energetic Infuser - Thermal Expansion

15.1. Description

Energetic Infusers take Rich Phyto-Gro and energize it to produce Fluxed Phyto-Gro. Each Energetic Infuser uses four (4) Auxiliary Reception Coil augments to increase production speed.

15.2. Flow Charts

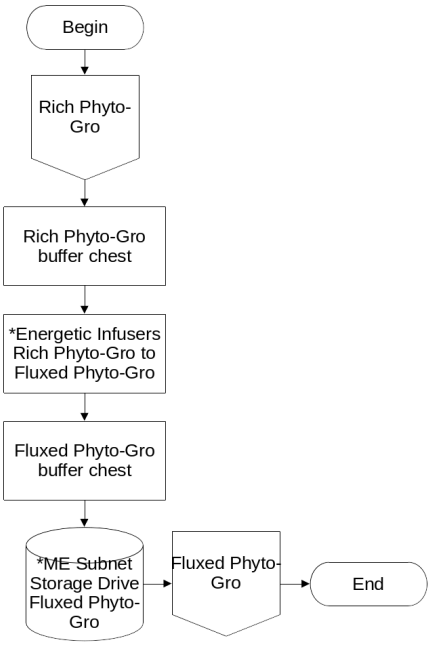
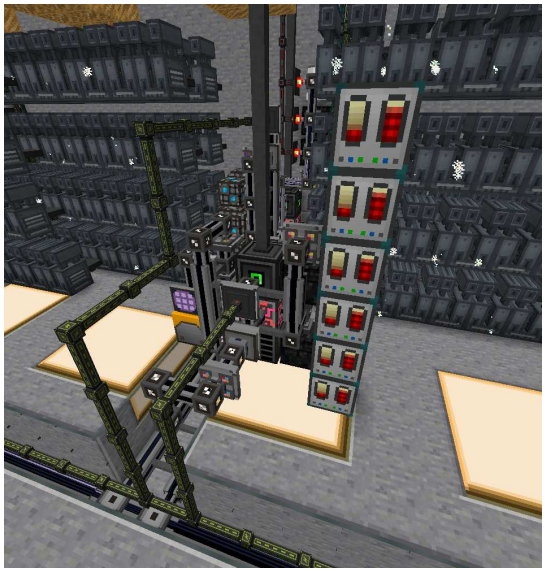


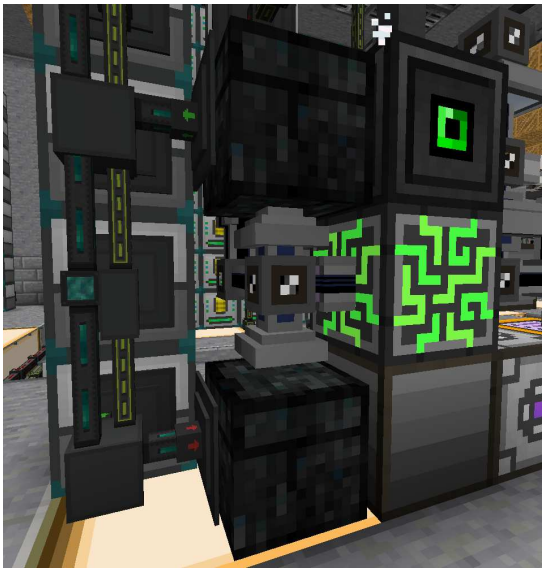
Figure 15-1. Fluxed Phyto-Gro Production Diagram

15.3. Setup Photos



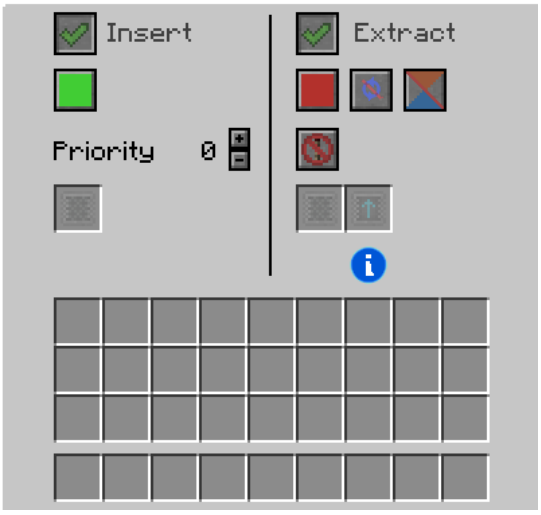
Photograph 15-1. Fluxed Phyto-Gro production systems

Photograph 15-2. Resource Provision Systems; P2P Tunnel (right) provides Rich Phyto-Gro.

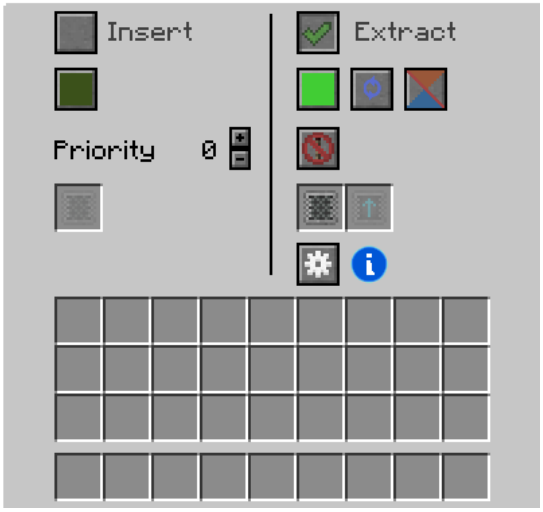


Photograph 15-3. Rich Phyto-Gro buffer chest (top), and Fluxed Phyto-Gro (bottom).

Configuration 15-1-1. Energetic Infusers augment configuration.

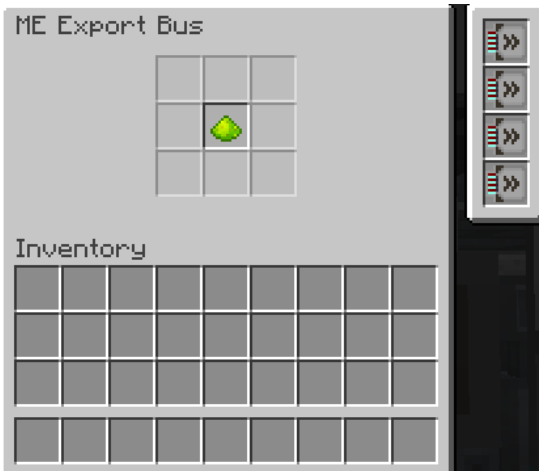


Configuration 15-1-2. Item Conduit configuration for Energetic Infusers.

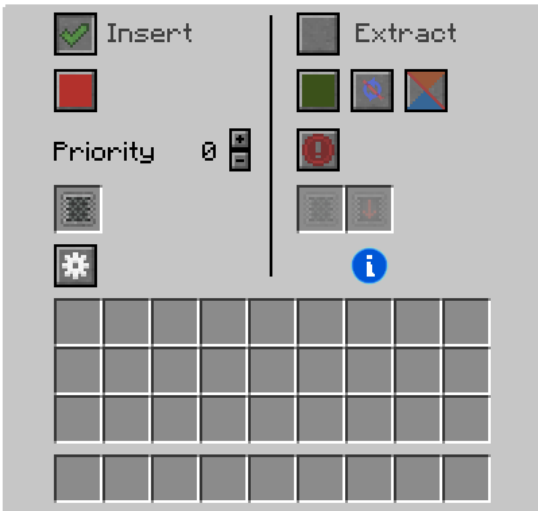


Configuration 15-2-1. Item Conduit configuration for Rich Phyto-Gro buffer chest.

Configuration 15-2-2. Item Conduit extract filter configuration for Rich Phyto-Gro buffer chest.

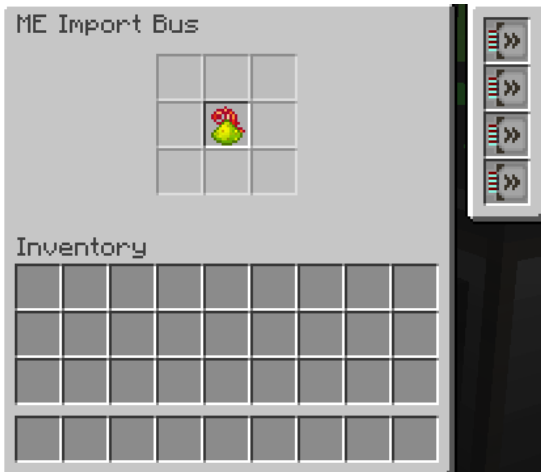


Configuration 15-2-3. ME configuration for Rich Phyto-Gro buffer chest.



Configuration 15-3-1. Item Conduit configuration for Fluxed Phyto-Gro buffer chest.

Configuration 15-3-2. Item Conduit insert filter configuration for Fluxed Phyto-Gro buffer chest.



Configuration 15-3-3. ME Import Bus configuration for Fluxed Phyto-Gro buffer chest.

Configuration 15-4-1. Product - Fluxed Phyto-Gro - ME Storage Bus

Configuration 15-4-2. Product - Fluxed Phyto-Gro - ME Interface

16. Redstone-Growing

The fourteenth stage of the production process involves producing Redstone. The following is an outline of the production process:

1 Fluxed Phyto-Gro and Water are inserted into Phytogenic Insolators. A single Red Orchid is present within each Phytogenic Insolator.

2 The above materials produce a single piece of Redstone.

3 Redstone is inserted into the Redstone buffer chest.

4 Redstone within the Redstone buffer chest is imported and stored in the AE production network.

5 If the quantity of Redstone within the production network falls below one-thousand twenty four (1024), emit a Redstone signal using a ME Level Emitter. A Redstone Conduit is attached to this ME Level Emitter which takes the redstone signal as input on the 'green' redstone channel.

Redstone is used in the following production stage(s):

- Rocket Fuel

The following machinery is used during this production stage:

- Phytogenic Insolator - Thermal Expansion

16.1. Description

During this stage of production, Redstone is grown inside of Phytogenic Insolators. The purpose of this stage is to mitigate the loss of Redstone due to the supply demand of the Rocket Fuel production stage. Each Phytogenic Insolator has the following augments installed: one (1) Monoculture Cycle, and three (3) Auxiliary Reception Coils.

If this stage cannot meet the supply demand of Redstone, then a Redstone signal will be emitted using a ME Level Emitter, as described in step 5 of the production process above.

16.2. Flow Charts

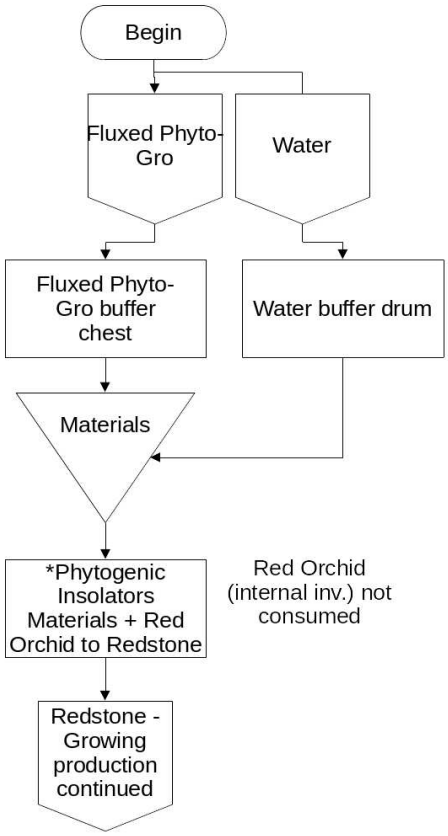


Figure 16-1. Redstone-Growing Production Diagram

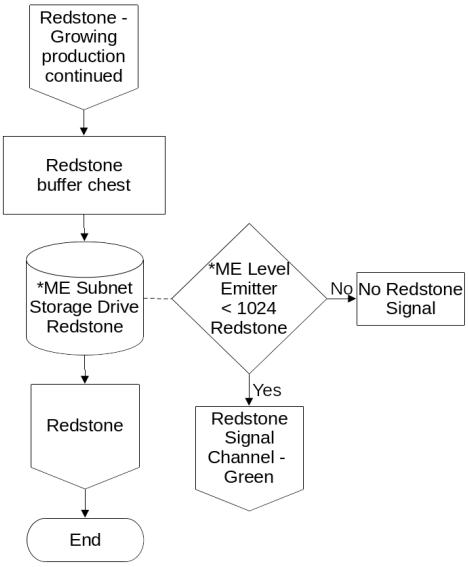
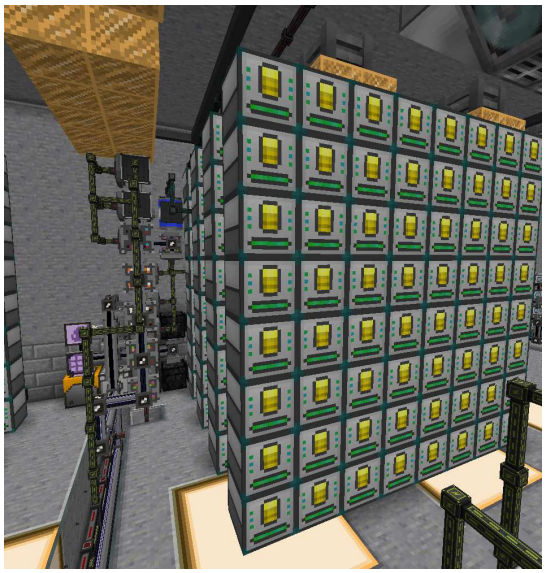


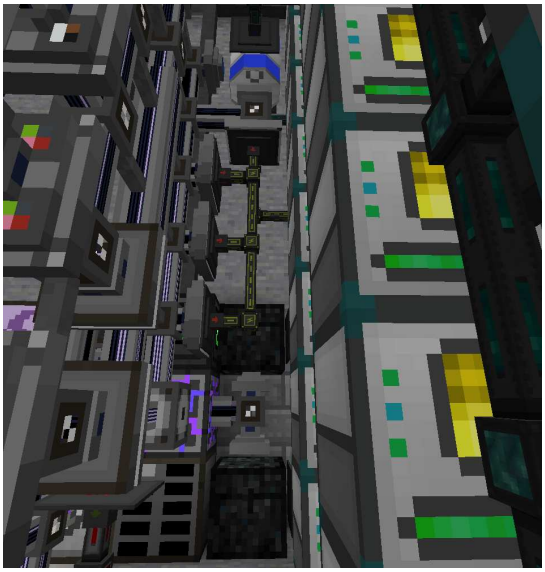
Figure 16-2. Redstone-Growing Production Diagram continued

16.3. Setup Photos

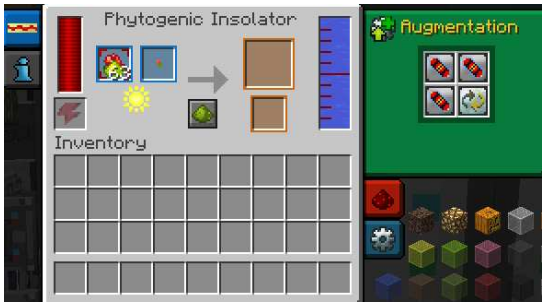


Photograph 16-1. Redstone-Growing production systems

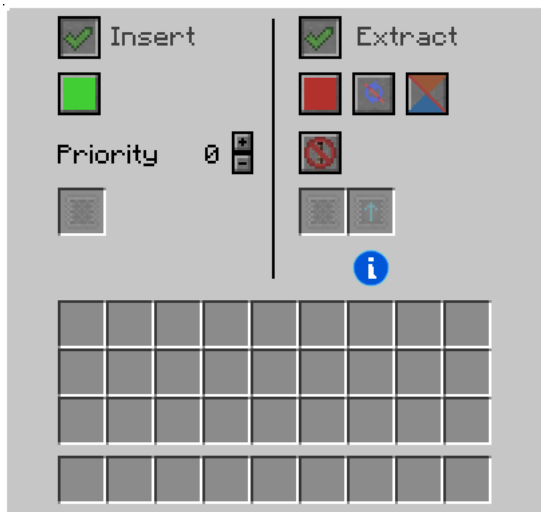
Photograph 16-2. Resource Provision Systems; Starting from top-to-bottom, three (3) P2P Tunnels provide Water, the last (bottom) P2P Tunnel provides Fluxed Phyto-Gro.



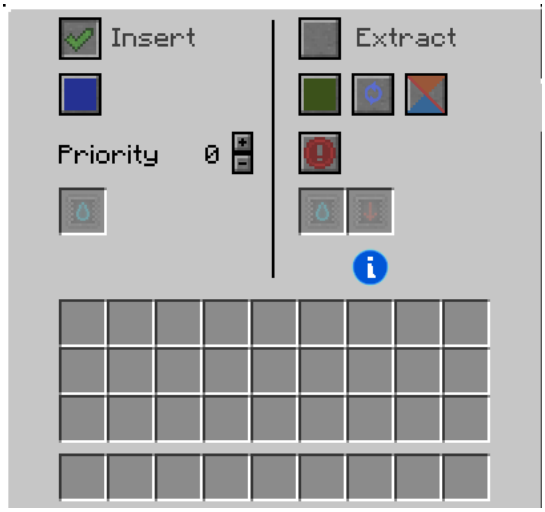
Photograph 16-3. Water buffer drum (top), Fluxed Phyto-Gro buffer chest (middle), and Redstone buffer chest (bottom).



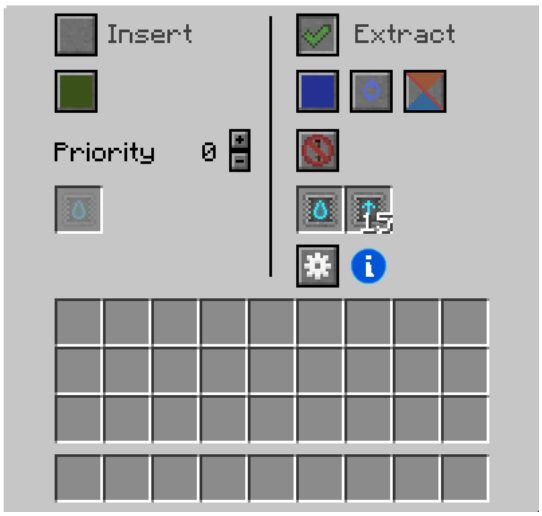
Configuration 16-1-1. Phytogenic Insolators augment configuration.



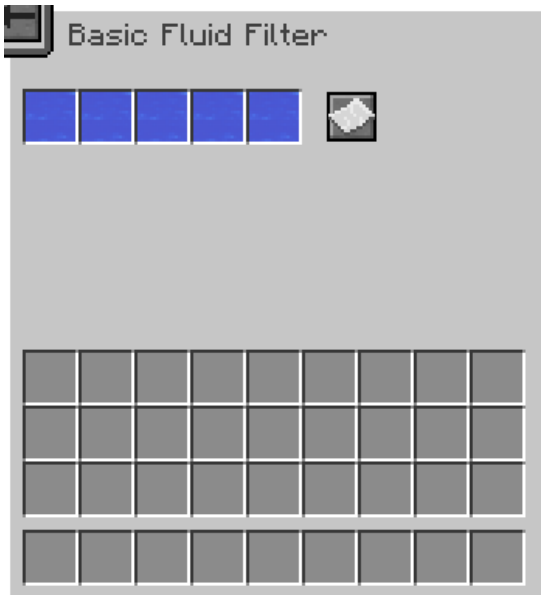
Configuration 16-1-2. Item Conduit configuration for Phytogenic Insolators.



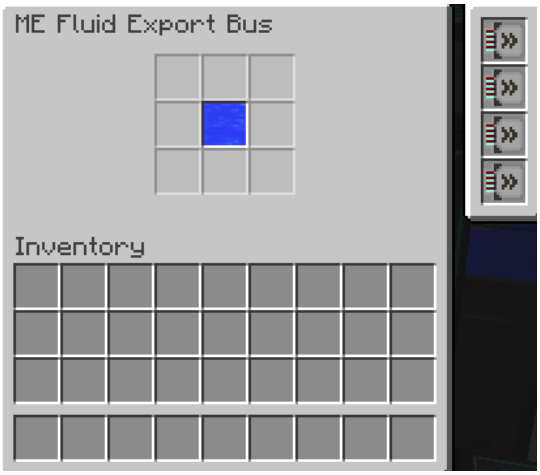
Configuration 16-1-3. Fluid Conduit configuration for Phytogenic Insolators.



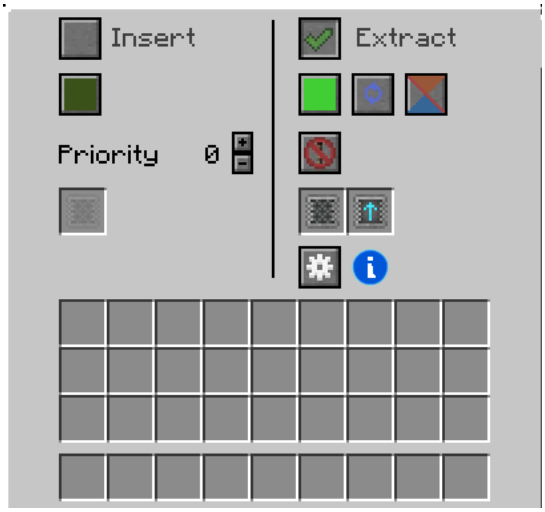
Configuration 16-2-1. Fluid Conduit configuration for Water buffer drum.



Configuration 16-2-2. Fluid Conduit extract filter configuration for Water buffer drum.

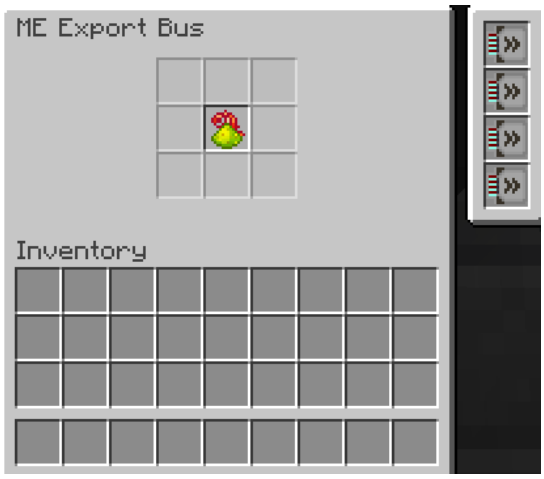


Configuration 16-2-3. ME Fluid Export Bus configuration for Water buffer drum.

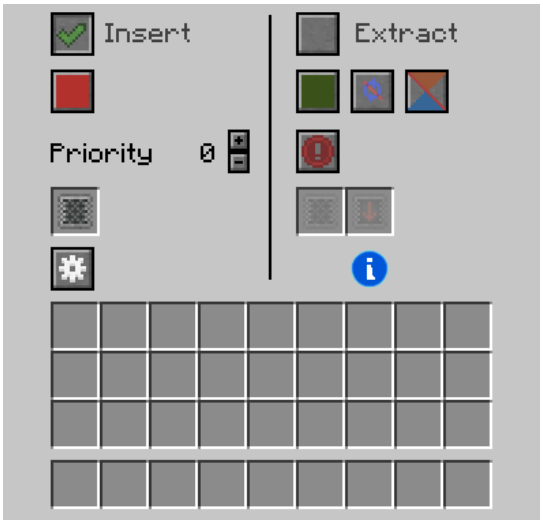


Configuration 16-3-1. Item Conduit configuration for Fluxed Phyto-Gro buffer chest.

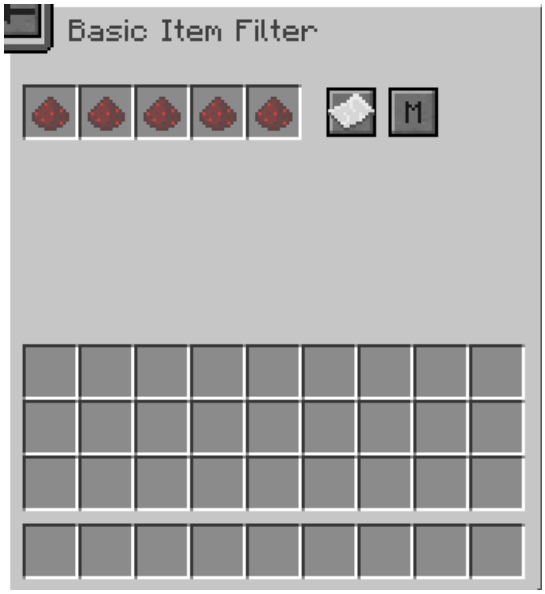
Configuration 16-3-2. Item Conduit extract filter configuration for Fluxed Phyto-Gro buffer chest.



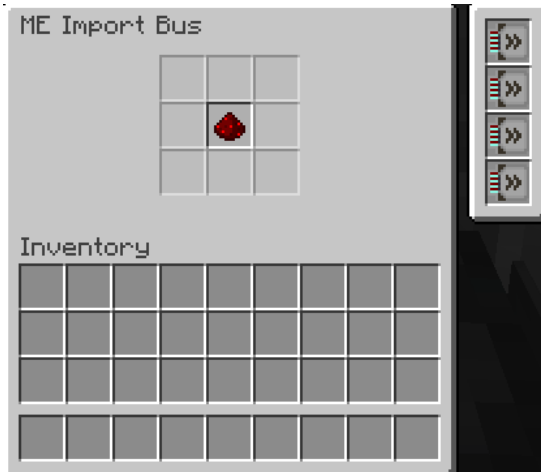
Configuration 16-3-3. ME Export Bus configuration for Fluxed Phyto-Gro buffer chest.



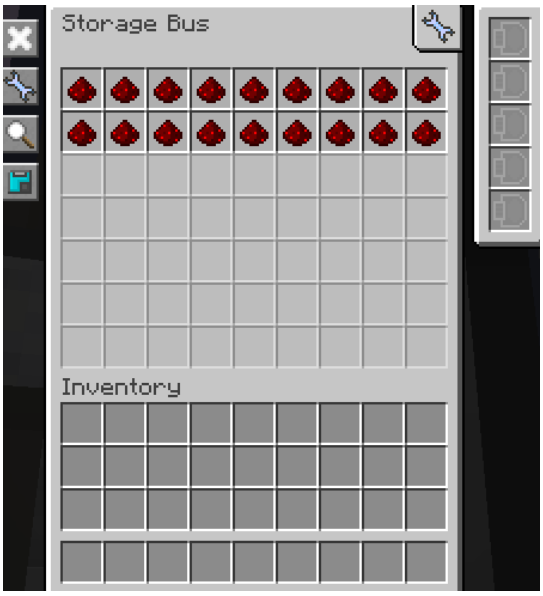
Configuration 16-4-1. Item Conduit configuration for Redstone buffer chest.



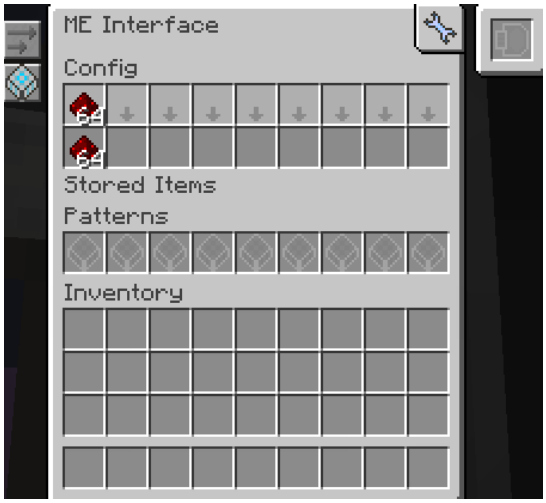
Configuration 16-4-2. Item Conduit insert filter configuration for Redstone buffer chest.



Configuration 16-4-3. ME Import Bus configuration for Redstone buffer chest.



Configuration 16-5-1. Product - Redstone - ME Storage Bus



Configuration 16-5-2. Product - Redstone - ME Interface

17. Mob Farm and Logic Systems

This section describes the systems used in the mob-spawning process. Such systems: route and nullify appropriate mob drops, control the on/off state of the mob spawners and accompanying subsystems, and emit redstone signals based on the quantity of Redstone and Gunpowder within the mob farm production system. Without these systems there would be nothing to control the spawning of mobs, and the routing logic of their drops. As such, the following systems are essential to the production process.

This section will deviate from the format described in section 1.2.

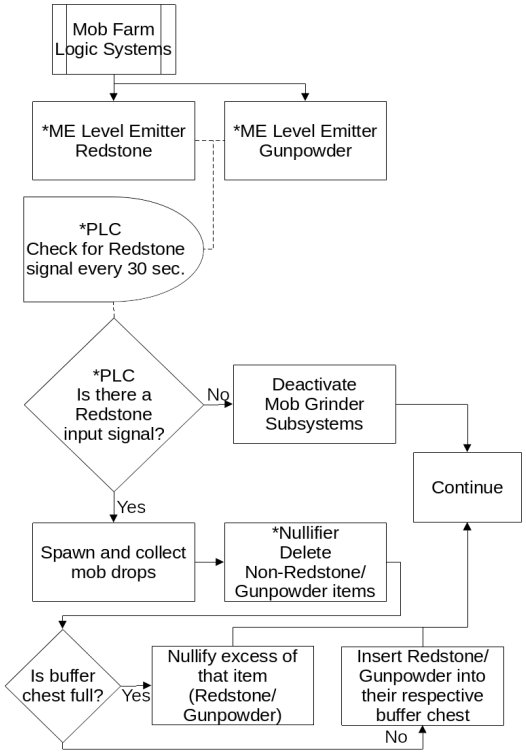


Figure 17-1. Mob Farm Subsystem Control and Mob Drop Routing Logic.

17.1. Mob Farm Logic Controller

The mob farm logic controller is comprised of four components: a Processor from the RFTools Control mod, two (2) ME Level Emitters, a breaker switch to toggle the mob farm on/off, and redstone conduits to use as the control signal transport medium (see section 17.1.1.). The mob farm logic controller uses the following components: (1x) CPU Core S1000, and (1x) RAM Chip 8E. Variable 0 is allocated to the primary program card (the program card which enables/disables the mob farm subsystems).

The mob farm logic controller has two (2) purposes which are as follows:

- Ensure the mob farm does not rapidly toggle itself on and off when the quantity of Redstone and Gunpowder in the AE production network reach maximum capacity.
- Provide a way to toggle on/off the mob farm using a separate redstone signal than the one provided by the ME Level Emitters.

The mob farm logic controller has two (2) Program Cards installed on it. The first (and primary) program operates in the following way:

1 An event ('Event: repeat' opcode) repeats every 600 ticks (30 seconds).

2 The program will then run the 'Eval: test lock' opcode to see if the lock of NAME is set (where NAME is a string) which returns true if the lock is set, or false if not set.

3 Using the 'Test: is value set/true' opcode, test to see if 'Eval: test lock' returned true or false.

4 If the 'Test: is value set/true' opcode returns true, then the redstone signal which controls the mob farm subsystems is disabled using the 'Operation: set redstone' opcode, the program will execute this opcode every time the program repeats execution, the program will not move past this point until the test above ('Test: is value set/true') returns false.

5 If 'Test: is value set/true' returns false, then the 'Eval: number' opcode evaluates and returns an integer of 15 (I). Where (I) specifies an integer.

6 This integer (15 (I)) is set as the value of the first variable (V:0), this variable is used as a parameter for a later opcode.

7 The redstone signal from the ME Level Emitters on SIDE (where SIDE is one of the six (6) sides (i.e. North, South, East, West, Top (up), Bottom (down))) is evaluated using the 'Eval: redstone' opcode, the value returned (an integer) is used in the next opcode ('Test: equality').

8 The 'Test: equality' opcode evaluates the last returned integer (the value of the redstone signal from the ME Level Emitters) and the value of the first variable (V:0), which when written as code looks like this: x == 15 (I). Where 15 (I) is the value of V:0. And X is the value of the last returned integer, which is the value returned by the previous opcode, 'Eval: redstone'.

9 If the redstone signal from the ME Level Emitters equals 15 (I), then enable the mob farm subsystems.

10 If the redstone signal from the ME Level Emitters does not equal 15 (I), then disable the mob farm subsystems. When this occurs the mob farm is put into the STANDBY Operating State (see section 17.2).

The second program card operates in the following way:

1 A redstone event ('Event: redstone on') is triggered if a redstone signal becomes a non-zero value on SIDE.

2 After triggering the 'Event: redstone on' event, the mob farm subsystems are disabled using the 'Operation: set redstone' opcode.

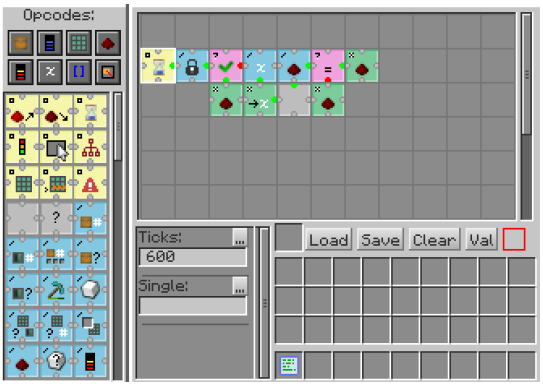
3 After disabling the mob farm subsystems, a lock with a name of NAME is set using the 'Operation: test and lock' opcode.

4 A redstone event ('Event: redstone off') is triggered if a redstone signal becomes a zero value on SIDE.

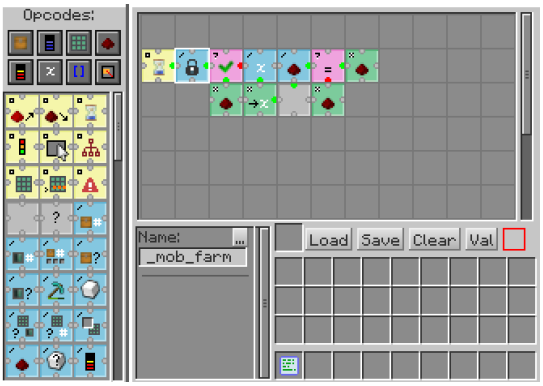
5 After triggering the 'Event: redstone off' event, the lock with the name of NAME is released using the 'Operation: release lock' opcode.

Photograph 17-1. The RFTools Control Processor, a Redstone Conduit (top) provides a signal to the Processor from the ME Level Emitters. A Redstone Conduit and Ender Energy Conduit provide a control signal to the mob farm subsystems, and energy for the Processor respectively.

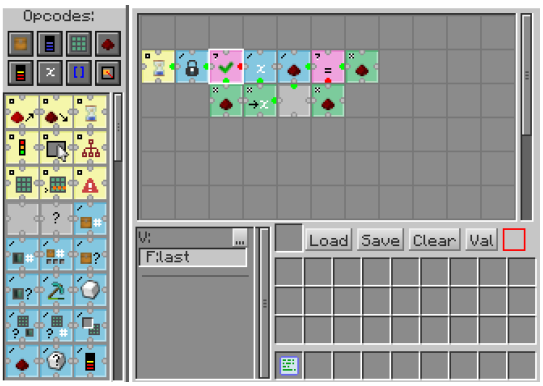
The first (and primary) program card used in the mob farm logic controller has the following configuration:



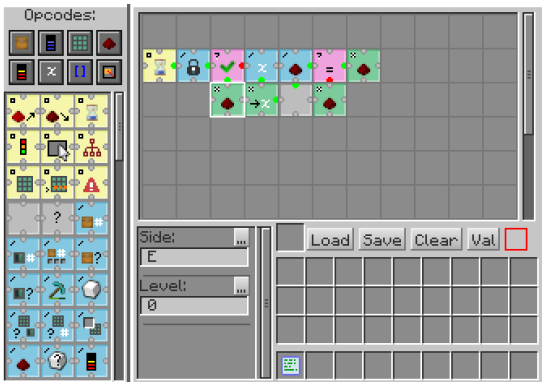
Configuration 17-1-1. Primary routine - Event: repeat.



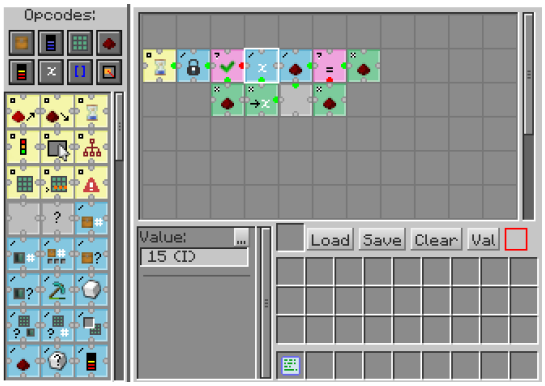
Configuration 17-1-2. Primary routine - Eval: test lock.



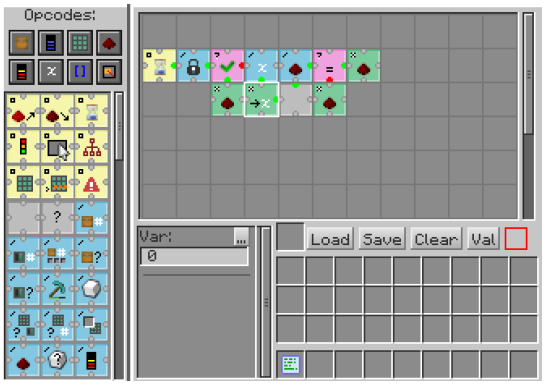
Configuration 17-1-3. Primary routine - Test: is value set/true.



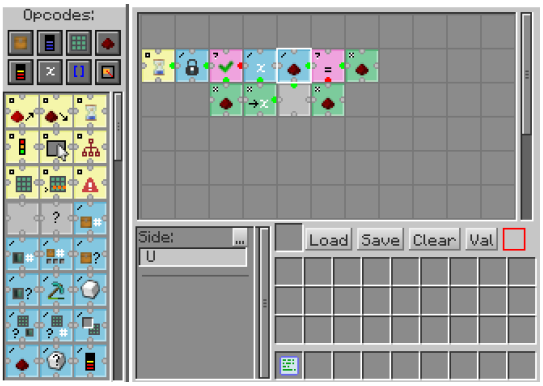
Configuration 17-1-4. Primary routine - If Test: is value set/true is true - Operation: set redstone.



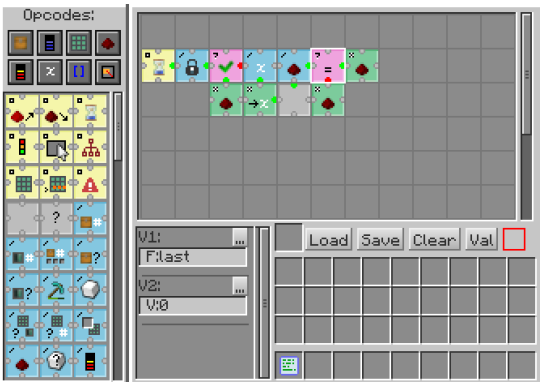
Configuration 17-1-5. Primary routine - If Test: is value set/true is false - Eval: number.



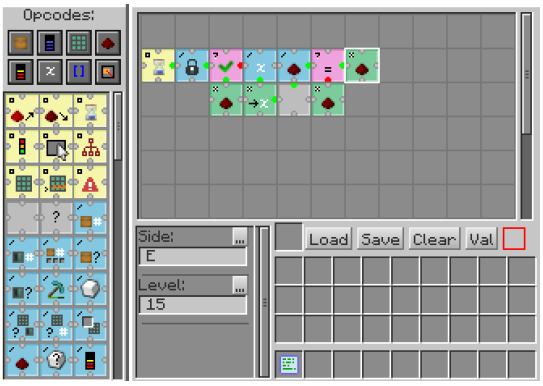
Configuration 17-1-6. Primary routine - Operation: set variable.



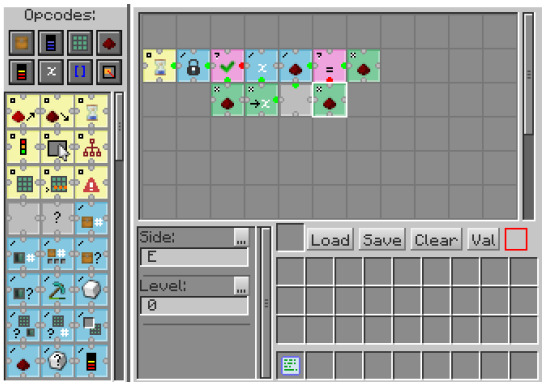
Configuration 17-1-7. Primary routine - Eval: read redstone.



Configuration 17-1-8. Primary routine - Test: equality.

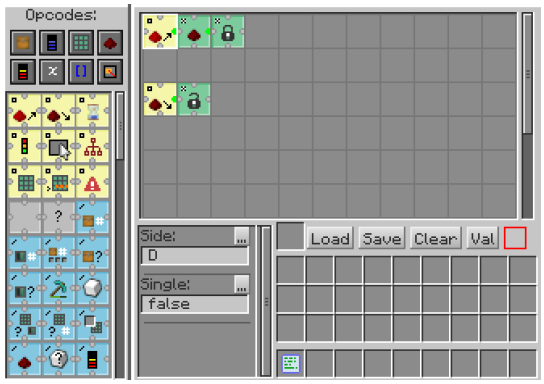


Configuration 17-1-9. Primary routine - If Test: equality is true - Operation: set redstone.

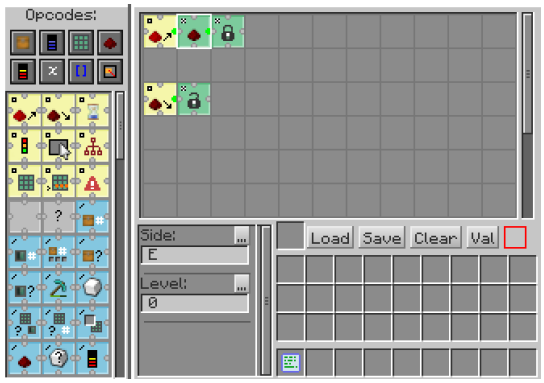


Configuration 17-1-10. Primary routine - If Test: equality is false - Operation: set redstone.

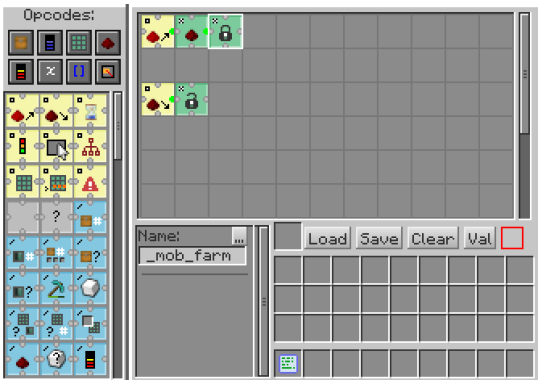
The second program card used in the mob farm logic controller has the following configuration:



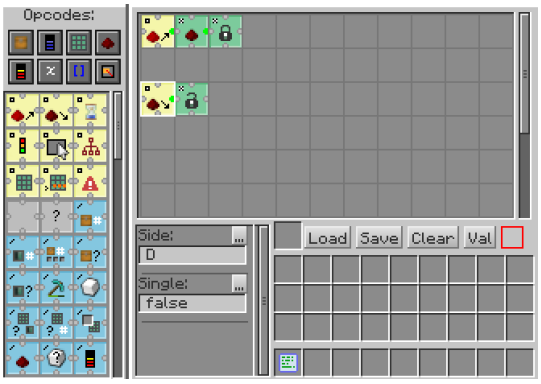
Configuration 17-2-1. Subroutine - Event: redstone on.



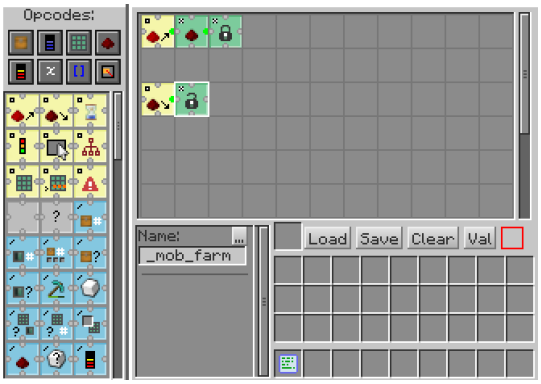
Configuration 17-2-2. Subroutine - Operation: set redstone.



Configuration 17-2-3. Subroutine - Operation: test and lock.



Configuration 17-2-4. Subroutine - Event: redstone off.



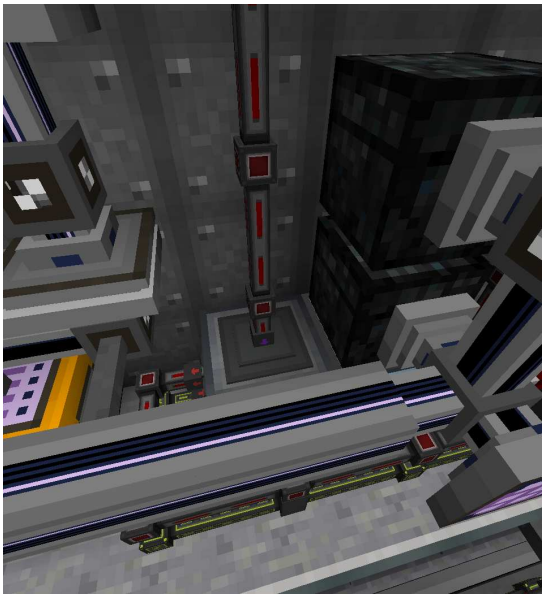
Configuration 17-2-5. Subroutine - Operation: release lock.

17.1.1. Control Signal and Transport Medium for the Mob Farm Logic Controller

Two (2) ME Level Emitters are used in this setup. The first will be configured to emit a redstone signal when below maximum capacity of Redstone (less than 520,192), the second will be configured to emit a redstone signal when below maximum capacity of Gunpowder (less than 520,192). A Redstone Conduit will connect to these ME Level Emitters, as shown in Photograph 17-2-1 which will take an input signal on the 'purple' channel. This Redstone Conduit will then connect on the top side of the mob farm logic controller, as shown in Photograph 17-2-2.

The mob farm logic controller will output a redstone signal on its left side. This signal will be inputted into a Redstone Conduit which will transfer that redstone signal over the 'red' redstone channel.

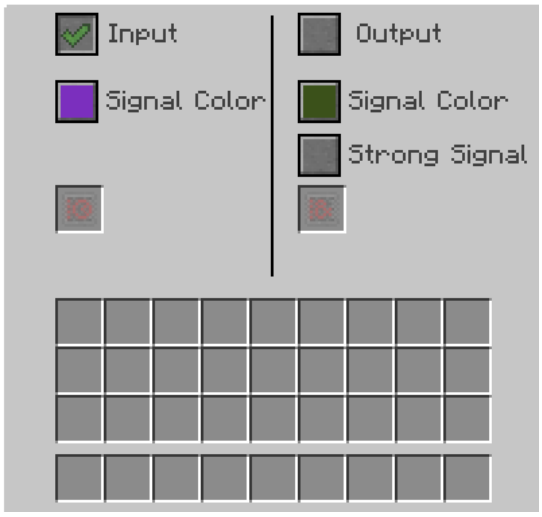
Photograph 17-2-1. Redstone Conduits connecting to the ME Level Emitters.



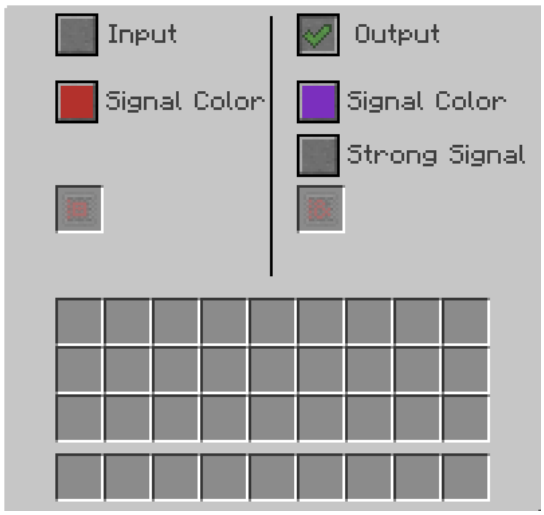
Photograph 17-2-2. Redstone Conduit connecting to the top of the mob farm logic controller.

Configuration 17-3-1. Level Emitter configuration for Redstone.

Configuration 17-3-2. Level Emitter configuration for Gunpowder.

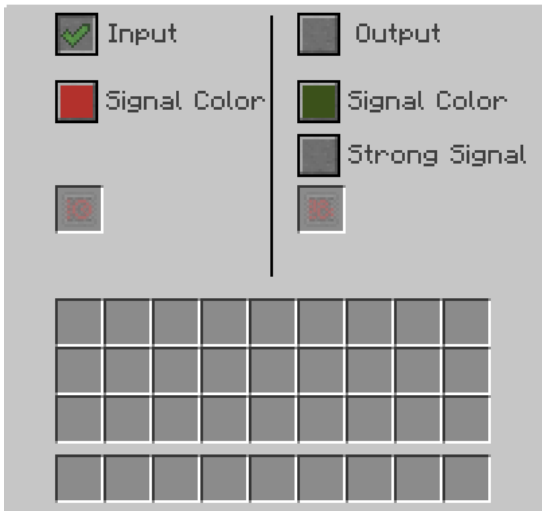


Configuration 17-3-3. Redstone Conduit configuration for connections to the ME Level Emitters.



Configuration 17-3-4. Redstone Conduit configuration for connection to top of the mob farm logic controller.

Photograph 17-2-3. Redstone Conduit on left side of the mob farm logic controller which provides the control signal to the mob farm's various subsystems.



Configuration 17-3-5. Redstone Conduit configuration for connection on the mob farm logic controller left side.

17.2. Operating State Advisory

What follows is a list of one or more Operation States that modify this production system's physical/logical behavior, along with the specific systems modified:

- STANDBY - When this production system is put into this state: the Nullifier is deactivated, the Powered Spawners are deactivated, and the Mob Mashers are deactivated. Additionally, mob drops which are not Redstone or Gunpowder will not be removed from the Absorption Hoppers. XP collected by the Absorption Hoppers and XP Vacuums will not be removed.

17.3. Mob Drop Routing

The routing system will prioritize the insertion of Redstone/Gunpowder into their respective buffer chest over inserting them into the Nullifier. However, Redstone/Gunpower MUST NOT be blacklisted from inserting into the Nullifier. EX: If the Gunpowder buffer chest is full, any extra Gunpowder will be inserted into the Nullifier, as that is the next available route.

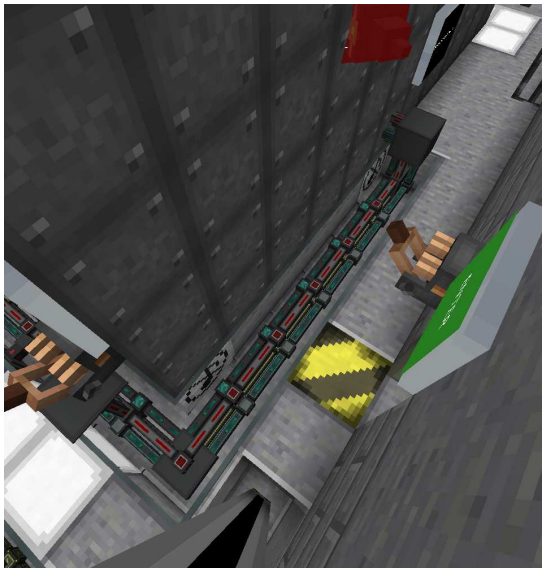
17.4. Mob Farm Containment Structure and Accompanying Subsystems

Mobs are spawned in a containment structure, who's external dimensions measure 20 meters x 11 meters x 7 meters (Length X Width X Height). Because Creepers will be spawned within this containment structure, the material(s) used to construct it MUST have a blast resistance value of 11.2 or higher.[3]

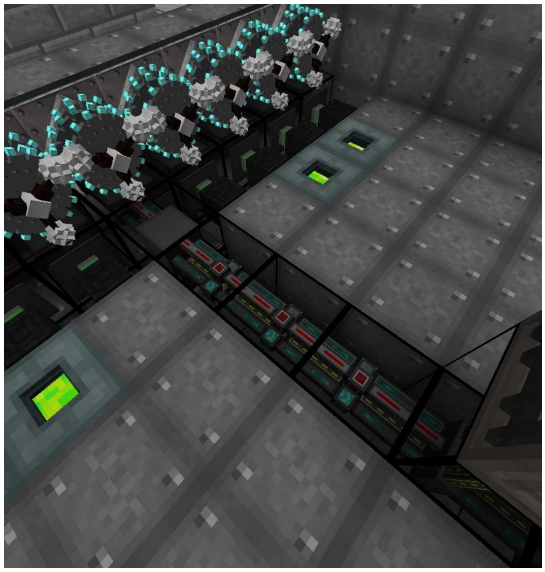
17.4.1. Containment Structure Wiring

The containment structure uses Item Conduits, Ender Fluid Conduits, Ender Energy Conduits, and Redstone Conduits to provide the subsystems material routing, energy, and control. These conduits are wrapped within a conduit bundle that runs throughout the containment structure, hidden by Hardened Conduit Facades which are painted as the same material as the containment structure.

Each Redstone Conduit is configured to output a redstone signal from the 'red' redstone channel. This is the redstone channel that is controlled by the mob farm logic controller.



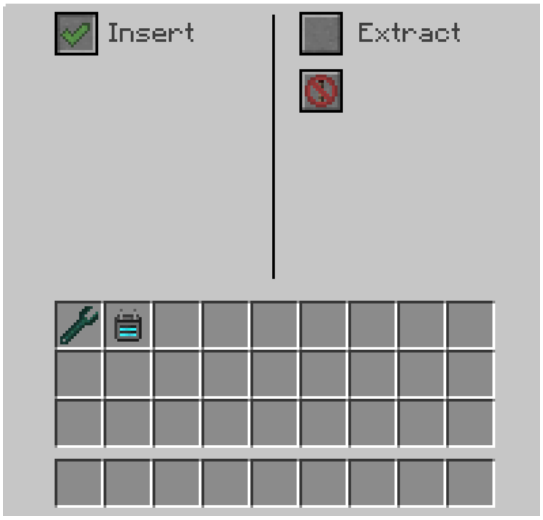
Photograph 17-3. The main conduit bundle coming from the buffer chests, mob farm logic controller, Nullifier, and eight (8) FE-configured P2P Tunnels (left). And going into the containment structure (right).



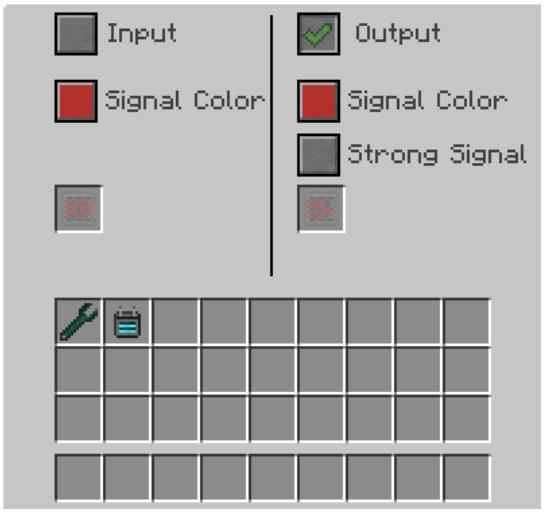
Photograph 17-4. The main conduit bundle hidden under the floor of the containment structure.

17.4.1.1. Wiring for Powered Spawners

Powered Spawners use Ender Energy Conduits and Redstone Conduits to provide energy and control. In the bottom row of Powered Spawners, those conduits connect to them on the bottom side. On the top row of Powered Spawners, those conduits connect to them on the top side, as shown in Photograph 17-9.



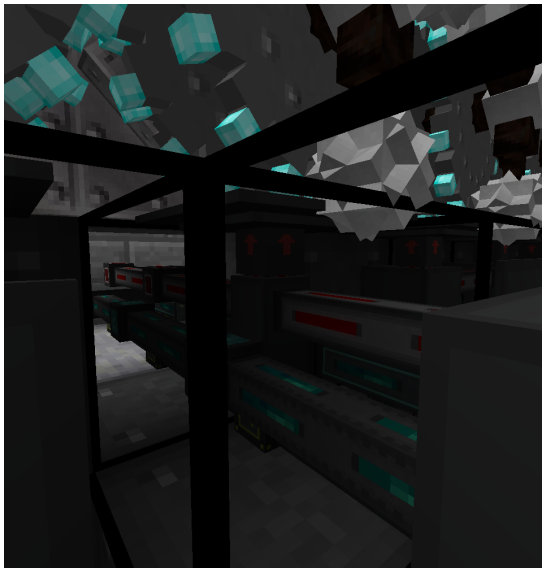
Configuration 17-4-1. Powered Spawners Energy Conduit configuration.



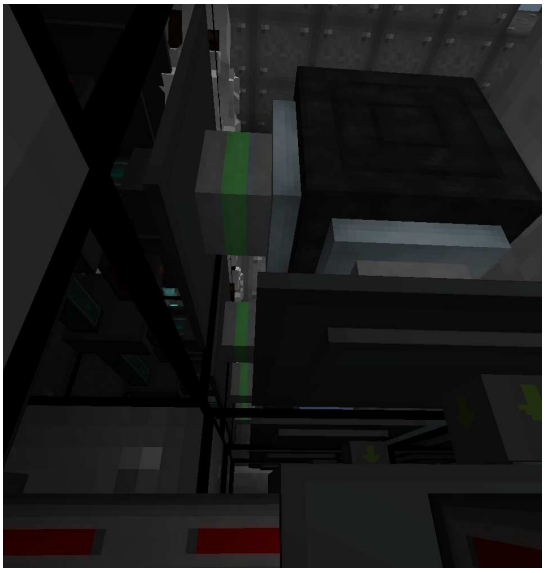
Configuration 17-4-2. Powered Spawners Redstone Conduit configuration.

17.4.1.2. Wiring for Mob Mashers

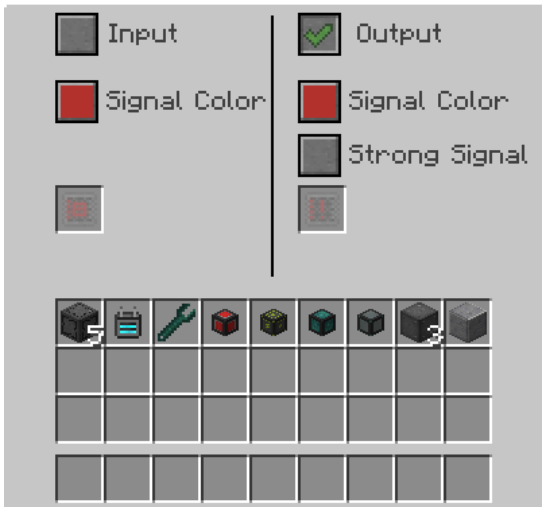
Mob Mashers use Redstone Conduits to toggle them on/off. Redstone Conduits connect to the Mob Mashers on the bottom side.



Photograph 17-5. Redstone Conduit placement for the Mob Mashers.



Photograph 17-6. Item Conduit and Ender Fluid Conduit placement for the Absorption Hoppers.

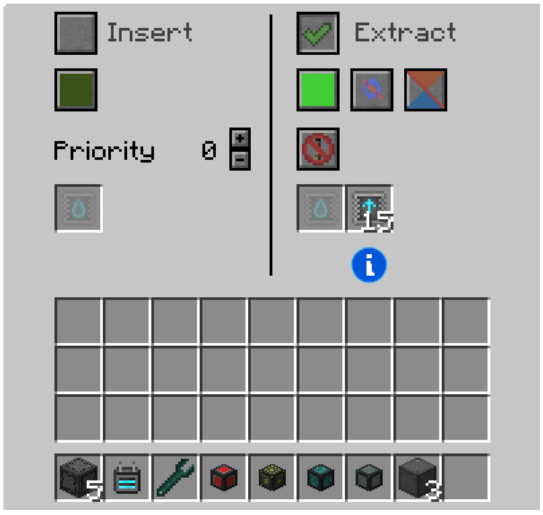


Configuration 17-5. Mob Mashers Redstone Conduit configuration.

Configuration 17-6-1. Absorption Hoppers Item Conduit configuration.

17.4.1.3. Wiring for Absorption Hoppers

Absorption Hoppers use Item Conduits and Ender Fluid Conduits to extract items and fluid from them. The Item Conduits connect on the bottom side of the Absorption Hoppers, while Ender Fluid Conduits connect on the side that faces toward the front of the containment structure (the front is the way mobs are being pushed).

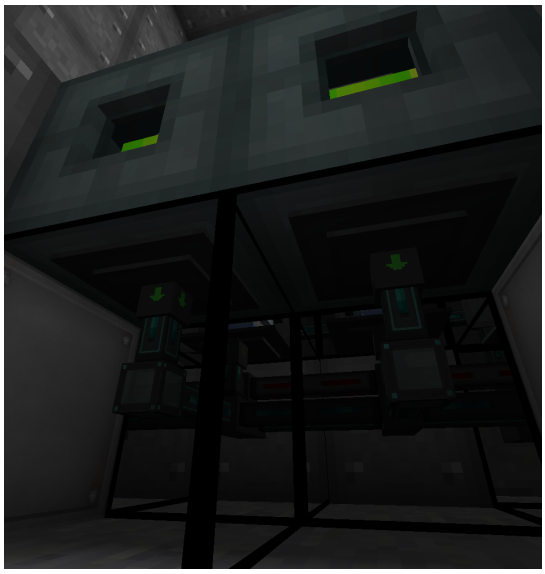


Configuration 17-6-2. Absorption Hoppers Ender Fluid Conduit configuration.

Configuration 17-7. XP Vacuums Ender Fluid Conduit configuration.

17.4.1.4. Wiring for XP Vacuums

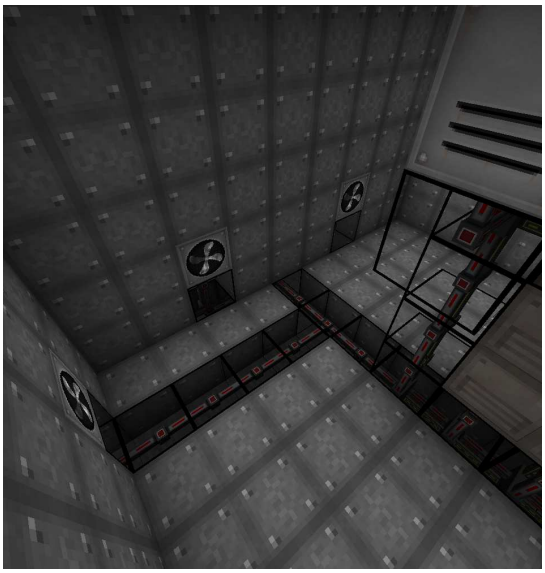
XP Vacuums use Ender Fluid Conduits to extract fluid from them. The Ender Fluid Conduits are placed on the bottom side of the XP Vacuums.



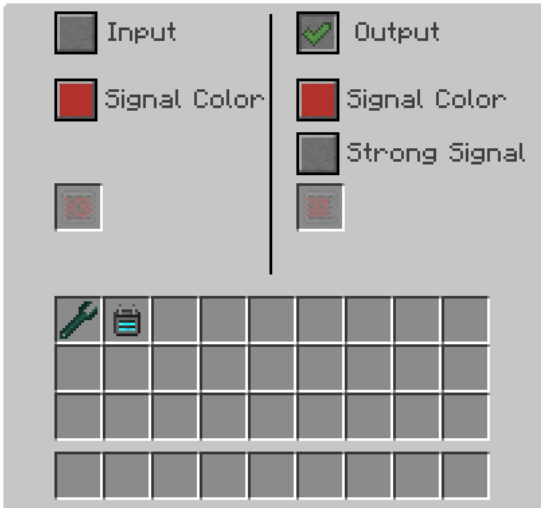
Photograph 17-7. Ender Fluid Conduit placement for the XP Vacuums.

17.4.1.5. Wiring for Mob Fans

Mob Fans use Redstone Conduits to toggle them on/off. Redstone Conduits connect to the Mob Fans on the bottom side.



Photograph 17-8. Redstone Conduit placement for the Mob Fans.

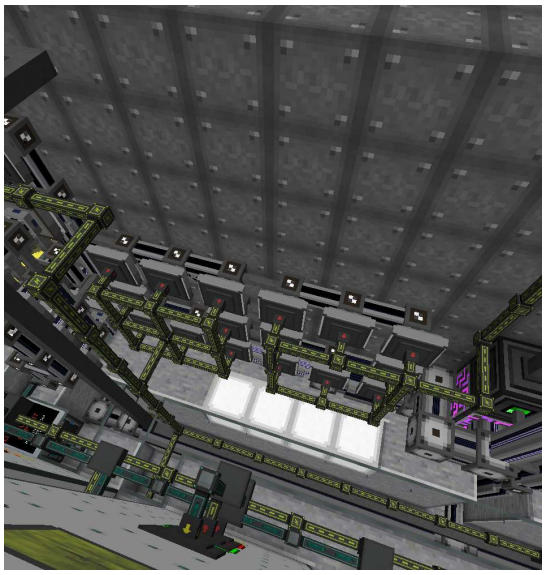


Configuration 17-8. Mob Fans Redstone Conduit configuration.

17.4.1.6. Power Delivery System

The Powered Spawners are the most power-intensive machines used in the Rocket Fuel production process. As such, the power delivery system MUST be capable of supplying sufficient power to the Powered Spawners, and the other mob farm subsystems.

To ensure sufficient power delivery, eight (8) Ender Energy Conduits supply power to the mob farm, for a maximum power throughput of 163,840 (FE/t).



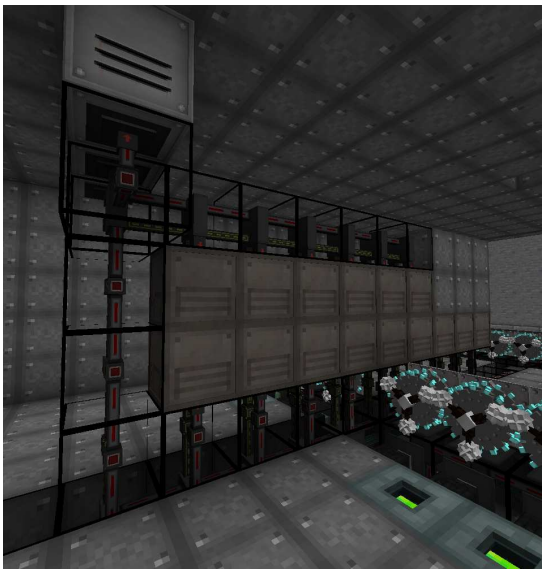
Photograph 17-9. Power Delivery System. Eight (8) P2P Tunnels take power from the main power line (left), the accompanying eight (8) P2P Tunnels output that power into the mob farm (right).

17.4.2. Mob Spawning Systems

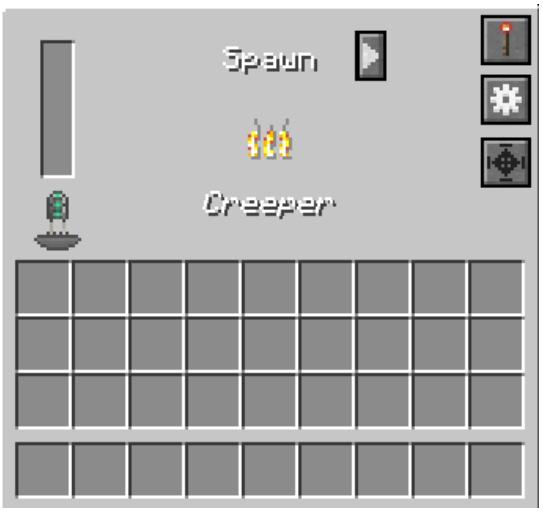
Within the containment structure there can be a total of eighteen (18) Powered Spawners which are broken up into two (2) rows consisting of nine (9) Powered Spawners per-row. The first row of Powered Spawners are to be placed one (1) meter above the floor of the containment structure (that is to say there is a one (1) meter gap between the first row of Powered Spawners and the containment structure floor). The second row of Powered Spawners are placed on top of the first row of Powered Spawners, making them two (2) meters above the containment structure floor.

All Powered Spawners MUST use Octadic Capacitors to ensure sufficient spawning speed. Using an Octadic Capacitor will allow a Powered Spawner to spawn mobs in a 9 meter x 9 meter x 4 meter area (Length X Width X Height). As such, a radius of four (4) meters MUST be kept between the Powered Spawners and the outside of the containment structure. The walls, floor, and ceiling count towards this four (4) meter radius, as Powered Spawners do not consider spawning mobs within solid material.

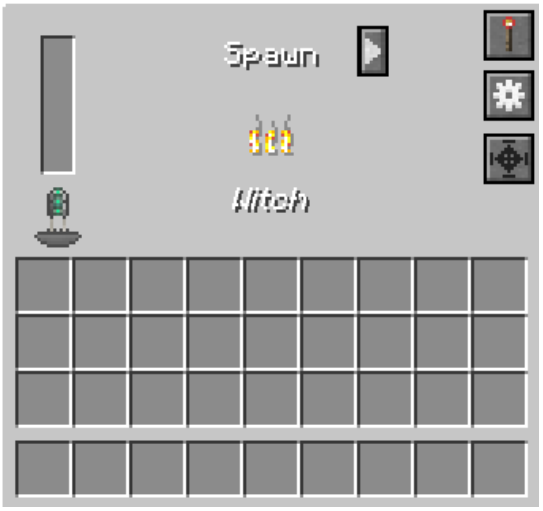
The Powered Spawners are toggled on/off using a redstone signal provided by Redstone Conduits, as such all Powered Spawners MUST have their Redstone Mode setting set to 'Active with signal'.



Photograph 17-10. The physical placement of the Powered Spawners, with conduit facades hidden.



Configuration 17-9-1. Configuration of Creeper Powered Spawners.



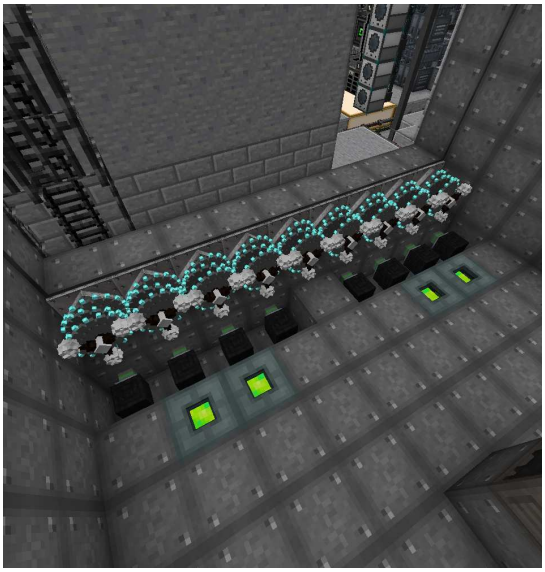
Configuration 17-9-2. Configuration of Witch Powered Spawners.

17.4.3. Mob Drop Collection

Mob drops and XP orbs are collected using Absorption Hoppers, XP Vacuums assist in collecting XP orbs. In total there are: sixteen (16) Absorption Hoppers, and eight (8) XP Vacuums. This is to ensure there are enough collection points to handle the large volume of material the mob farm produces.

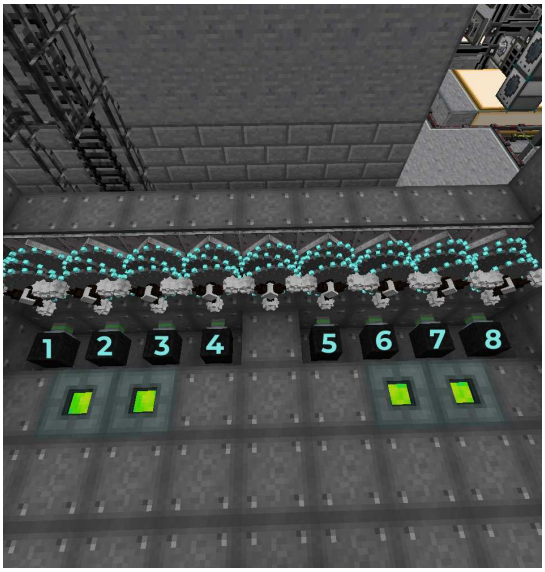
17.4.3.1. Absorption Hoppers

With the exception of vertical space, the Absorption Hoppers are configured to cover the internal area of the containment structure only. To do this each Absorption Hopper needs to be configured based on its placement within the containment structure.

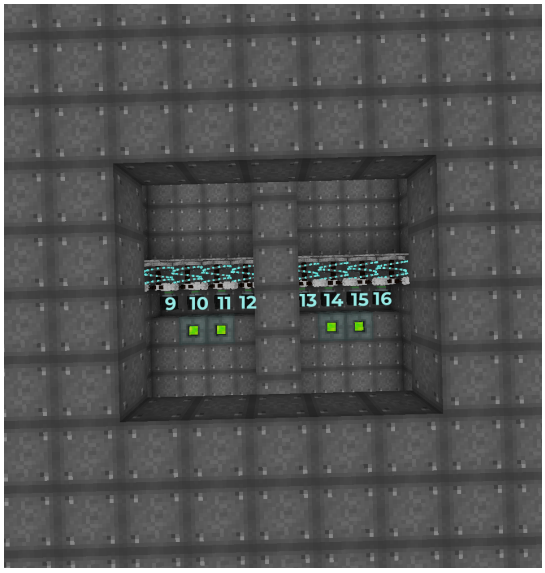


Photograph 17-11. Absorption Hoppers and XP Vacuums.

What follows are two photographs depicting Absorption Hoppers numbered in incrementing order from left-to-right. These photographs will be used to reference the specific Absorption Hopper being configured in section 17.4.3.1.1.



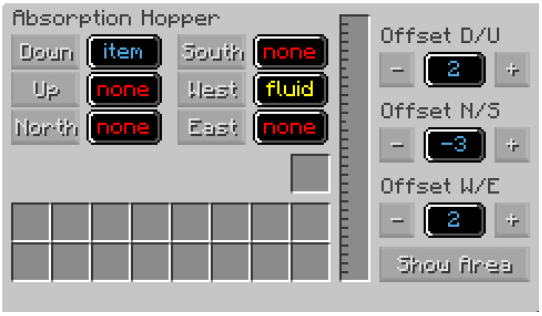
Photograph 17-12-1. Numbered Absorption Hoppers 1 through 8.



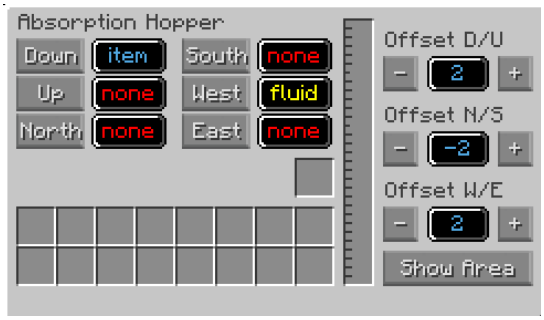
Photograph 17-12-2. Numbered Absorption Hoppers 9 through 16.

17.4.3.1.1. Absorption Hopper Configurations

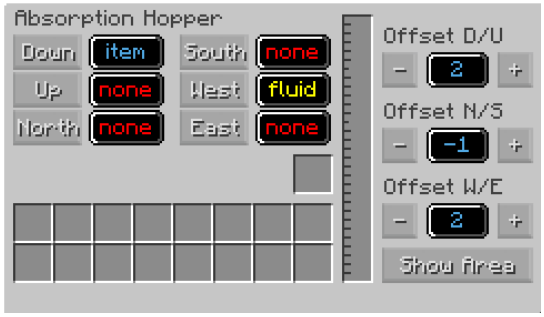
This section provides configuration screenshots for Absorption Hoppers 1-16, each screenshot will have the accompanying text: 'Configuration for Absorption Hopper N' where N is a number corresponding to the number-labels over each Absorption Hopper, as shown in Photograph 17-12-1 and Photograph 17-12-2.



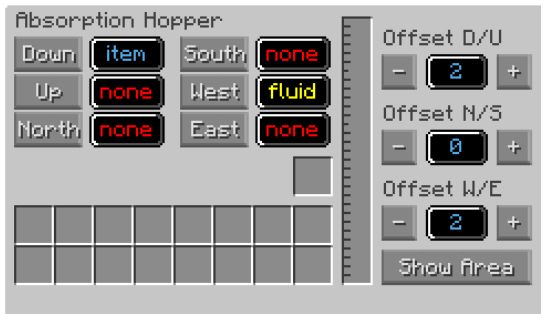
Configuration 17-10-1. Configuration for Absorption Hopper 1.



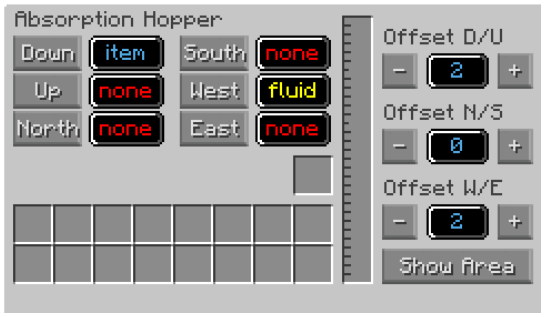
Configuration 17-10-2. Configuration for Absorption Hopper 2.



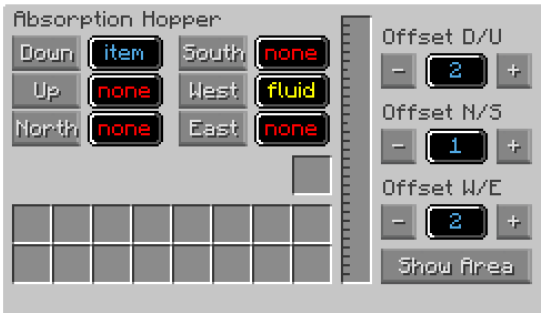
Configuration 17-10-3. Configuration for Absorption Hopper 3.



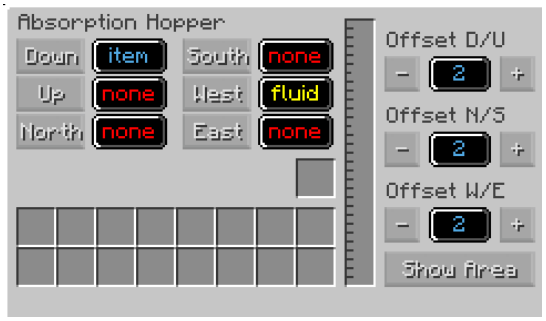
Configuration 17-10-4. Configuration for Absorption Hopper 4.



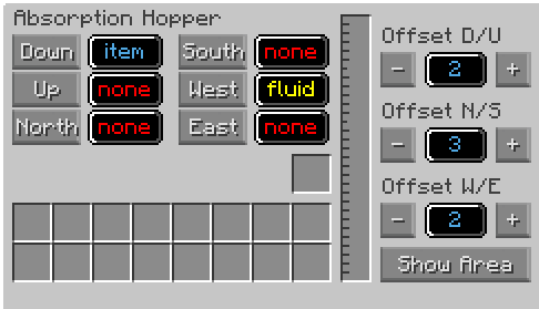
Configuration 17-10-5. Configuration for Absorption Hopper 5.



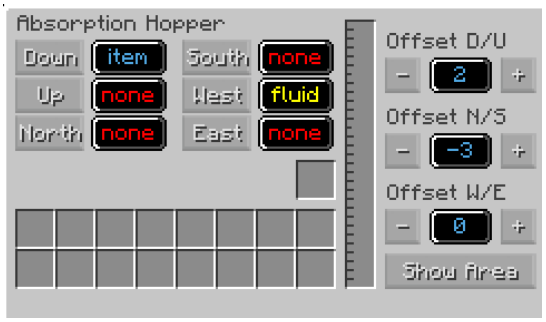
Configuration 17-10-6. Configuration for Absorption Hopper 6.



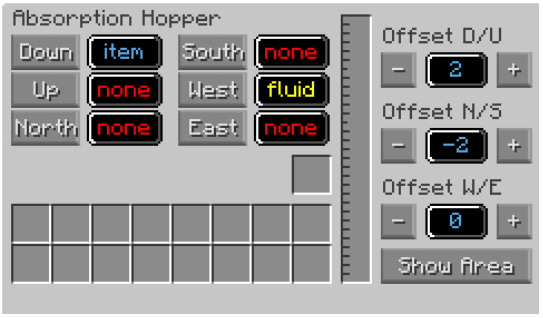
Configuration 17-10-7. Configuration for Absorption Hopper 7.



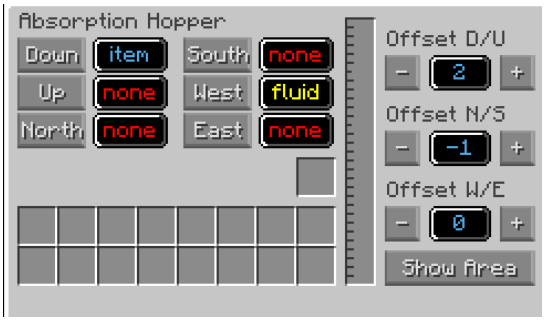
Configuration 17-10-8. Configuration for Absorption Hopper 8.



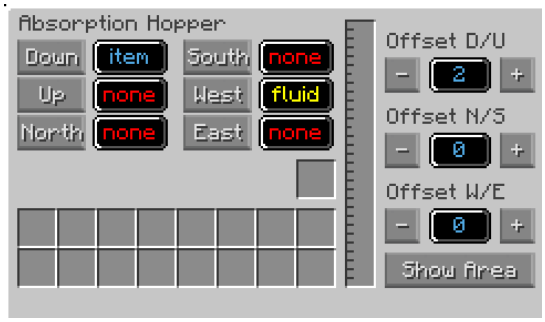
Configuration 17-10-9. Configuration for Absorption Hopper 9.



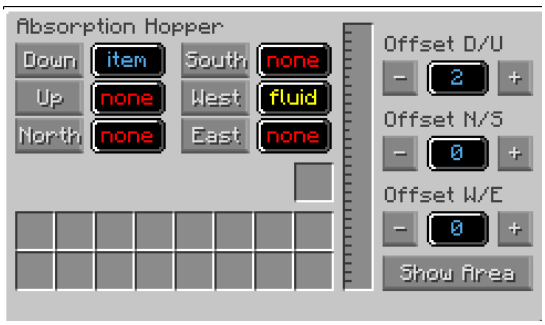
Configuration 17-10-10. Configuration for Absorption Hopper 10.



Configuration 17-10-11. Configuration for Absorption Hopper 11.



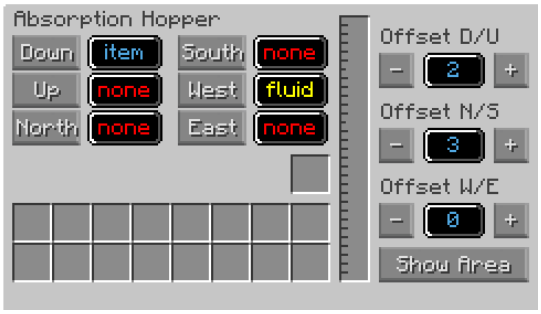
Configuration 17-10-12. Configuration for Absorption Hopper 12.



Configuration 17-10-13. Configuration for Absorption Hopper 13.

Configuration 17-10-14. Configuration for Absorption Hopper 14.

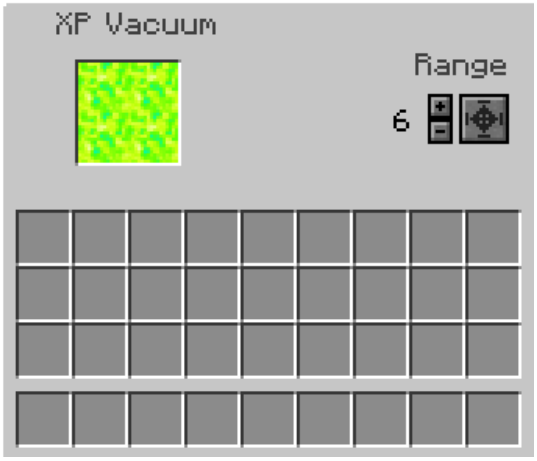
Configuration 17-10-15. Configuration for Absorption Hopper 15.



Configuration 17-10-16. Configuration for Absorption Hopper 16.

17.4.3.2. XP Vacuums

XP Vacuums are placed in-front of the Absorption Hoppers, as shown in Photograph 17-11. They are configured for maximum range, which is a radius of six (6) meters.



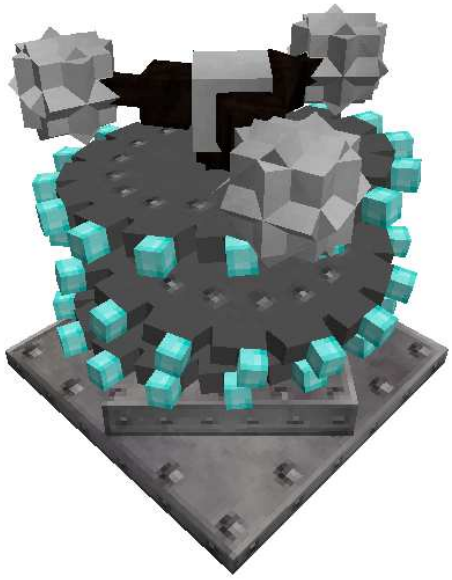
Configuration 17-11. Configuration of the XP Vacuums.

17.4.4. Mob Termination

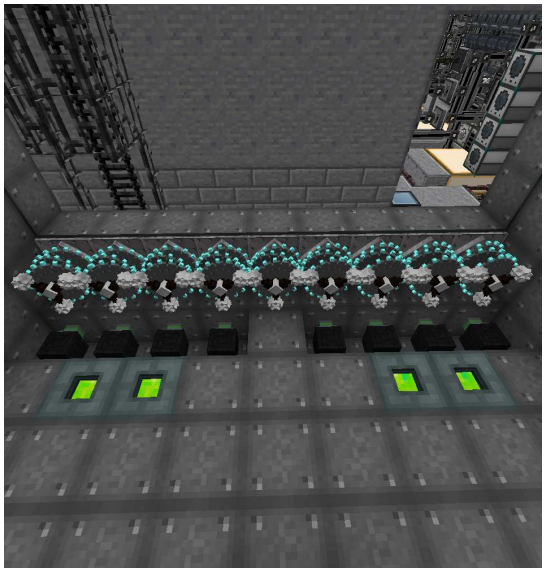
The mob farm terminates the spawned mobs using Mob Mashers. In total there are seventeen (17) Mob Mashers broken up into three (3) sets.

The first set consists of nine (9) Mob Mashers, which are located at the front of the containment structure. The second and third sets consist of four (4) Mob Mashers each, which are separated by eight (8) meters from the first Mob Masher set, as shown in Photograph 17-13-4. The second and third Mob Masher sets are positioned further into the containment structure to increase the mob termination rate. This is important as the Powered Spawners will scan the nearby area for mobs, if there are more than six (6) mobs around the Powered Spawner (by default configuration) then they will not spawn more mobs. So ideally, mobs should be terminated as fast as possible.

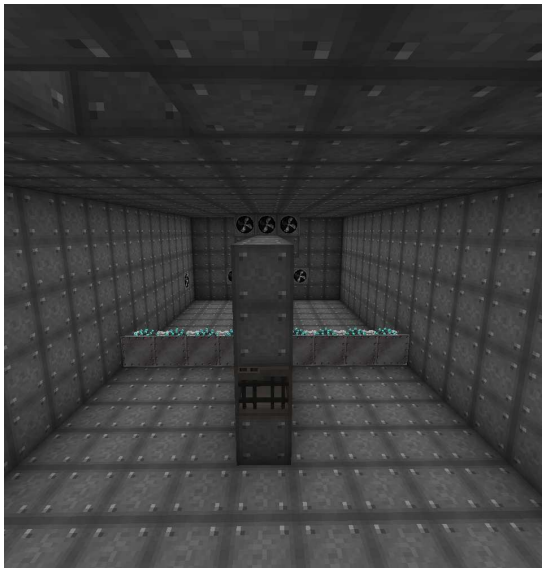
Each Mob Masher is given ten (10) Sharpness upgrades and ten (10) Looting upgrades to increase time-to-kill, and mob drops respectively. Each Mob Masher is controlled using a redstone signal provided by a Redstone Conduit.



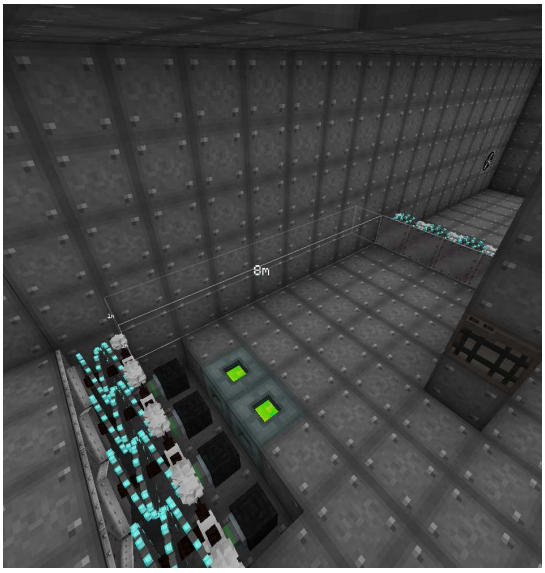
Photograph 17-13-1. In-game model of the Mob Masher.



Photograph 17-13-2. The first set of Mob Mashers.



Photograph 17-13-3. The second and third Mob Masher sets.



Photograph 17-13-4. Distance between first Mob Masher set and the second and third Mob Masher set.

Configuration 17-12. Mob Masher upgrades. Ten (10) Sharpness upgrades (left), and ten (10) Looting upgrades (right).

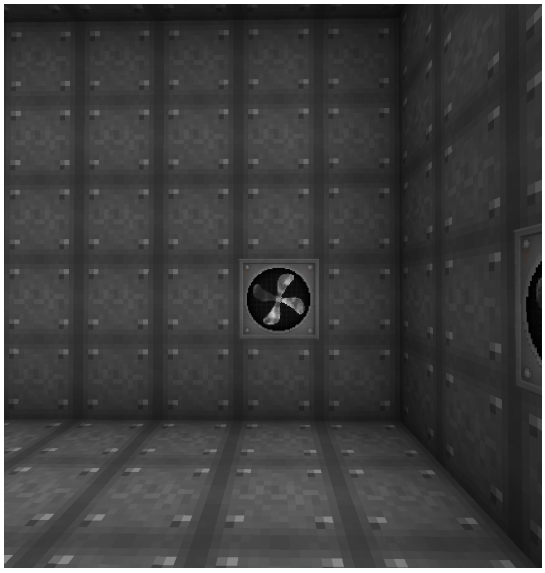
17.4.5. Mob Routing

Mob Fans push the spawned mobs into the Mob Mashers. These Mob Fans are strategically placed within the containment structure to ensure the mobs do not get stuck, and that mobs are routed into the Mob Mashers efficiently. Within the containment structure there are six (6) Mob Fans with three (3) different configurations.

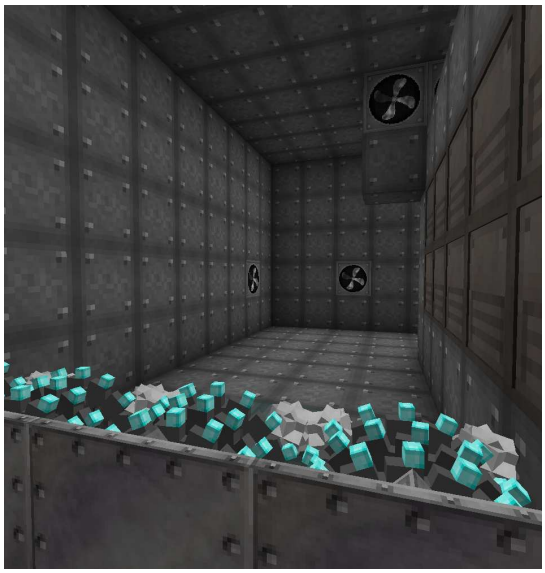
17.4.5.1. Mob Fan Left Wall

On the left-side of the containment structure there is a Mob Fan which makes sure mobs do not get pushed into the back of the Powered Spawners. This Mob Fan uses: two (2) Width Modifiers, one

(1) Height Modifier, and one (1) Distance Modifier.



Photograph 17-14-1. Mob Fan on the left-side of the containment structure, the Mob Fan is located one (1) meter right of the back wall, and one (1) meter above the floor.

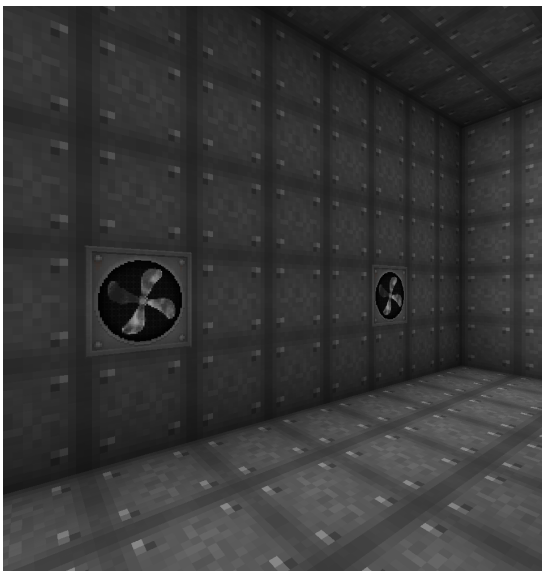


Photograph 17-14-2. Left Mob Fan from another point-of-view.

Configuration 17-13. Left Mob Fan upgrades.

17.4.5.2. Mob Fans Back Wall

There are two (2) Mob Fans on the back wall that overlap coverage areas with each other, nearly encompassing the entire interior space of the containment structure. Both Mob Fans use three (3) Width Modifiers, three (3) Height Modifiers, and ten (10) Distance Modifiers.

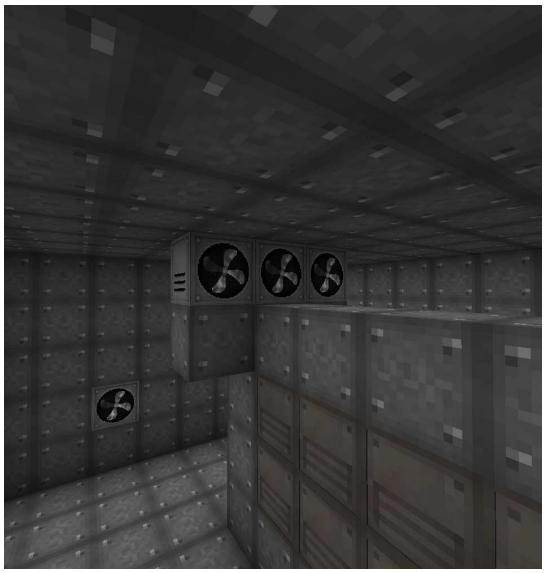


Photograph 17-15. Mob Fans on the back wall of the containment structure.

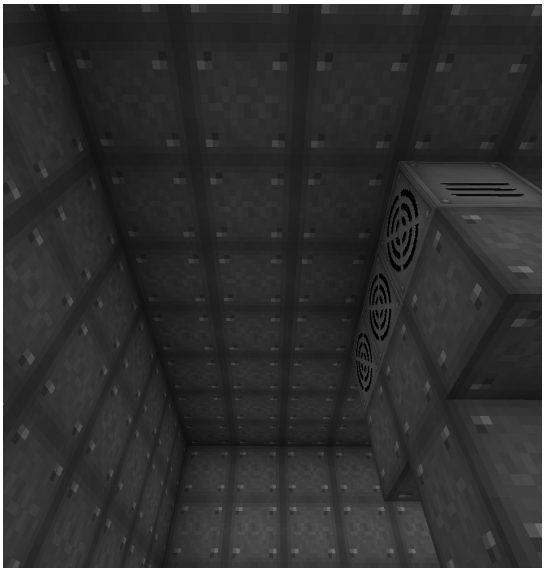
Configuration 17-14. Back wall Mob Fan upgrades.

17.4.5.3. Mob Fans Ceiling

The last set of Mob Fans are located on the ceiling of the containment structure three (3) meters from the back wall, there are three (3) Mob Fans in this set. The purpose of these three Mob Fans is to push mobs the last couple of meters that the Mob Fans on the back wall do not reach. These Mob Fans use: three (3) Width Modifiers, three (3) Height Modifiers, and nine (9) Distance Modifiers.



Photograph 17-16-1. Mob Fans on the ceiling of the containment structure.



Photograph 17-16-2. Alternate view of the ceiling Mob Fans showing the distance between them and the back wall.

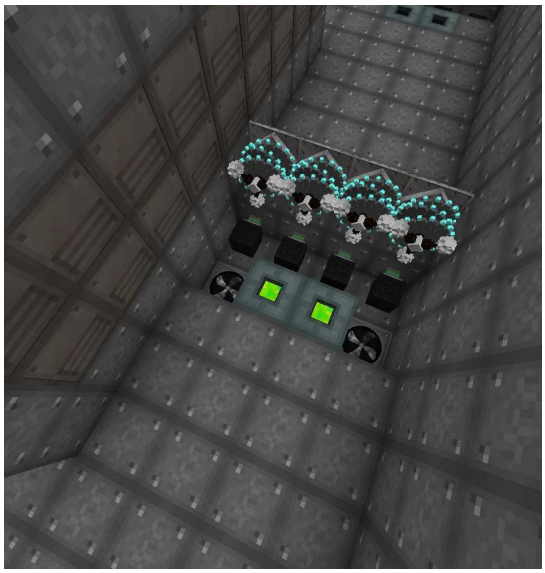
Configuration 17-15. Ceiling Mob Fan upgrades.

17.4.6. Mitigating Mobs from becoming Stuck within Containment Structure

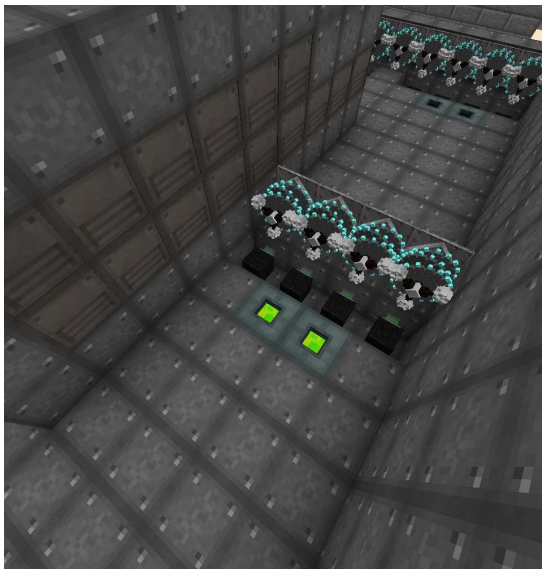
When using Conduit Facades, mobs (including the player) has a tendency to phase through them. Since the containment structure uses Hardened Conduit Facades on its floor, mobs tend to become stuck. To mitigate this, Mob Fans are placed one (1) meter under the floor, which are located to either side of the XP Vacuums. These push mobs up from the Hardened Conduit Facade they have phased through. Because a block is placed directly over the Mob Fans, their range is significantly reduced, which is a 3 meter x 3 meter x 1 meter (Length X Width X Height) area. These Mob Fans use: one (1) Width Modifier, and one

(1) Height Modifier.

These Mob Fans are toggled on/off by Redstone Conduits, which attach on the bottom side of the block.

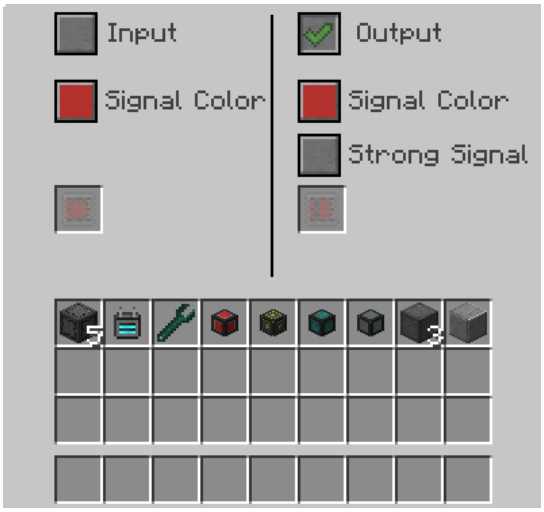


Photograph 17-17-1. Exposed view of the Mob Fans.



Photograph 17-17-2. Hidden view of the Mob Fans.

Configuration 17-16. Mob stuck mitigating Mob Fans upgrades.



Configuration 17-17. Mob stuck mitigating Mob Fans Redstone Conduit configuration.

17.4.7. Mob Death Sound Muffling

To lessen the noise created by the constant death of mobs, place a Sound Muffler (from Extra Utilities 2) underneath each of the four corners of the containment structure. This is optional.

Photograph 17-18. Sound Muffler underneath a corner of the containment structure.

17.4.8. Comment by Author

In Photograph 17-10, the physical Powered Spawners are depicted. As shown in said Photograph, only fifteen (15) Powered Spawners are being used (eleven (11) Witch Powered Spawners and four (4) Creeper Powered Spawners). While adding more than eleven (11) Witch Powered Spawners is certainly feasible, it is not recommended. This is because the increased Witch spawn rate will cause the Powered Spawners to idle more frequently, due to the maximum amount of mobs in the area being reached.

17.5. Machinery Used

- Absorption Hopper - mob_grinding_utils
- Mob Fan - mob_grinding_utils
- Mob Masher - mob_grinding_utils
- Nullifier - Thermal Expansion
- Powered Spawner - Ender IO
- Processor - RFTools Control
- XP Vacuum - Ender IO

18. Redstone and Gunpowder

The fifteenth stage of the production process involves producing Redstone and Gunpowder. The following is an outline of the production process:

1 Mobs are spawned and terminated within the mod farm containment structure.

2 Mob drops are collected by the mob farm subsystems, unwanted material is inserted into a Nullifier or if the buffer chest designated for a specific wanted material is full, that material will too be inserted into the Nullifier.

3 Wanted material, Redstone/Gunpowder is inserted into their appropriate buffer chests.

4 Redstone/Gunpowder within their respective buffer chests are imported and stored within the AE production network.

5 If Redstone within the production network falls below one-thousand twenty four (1024), then emit a Redstone signal using a ME Level Emitter. A Redstone Conduit is attached to this ME Level Emitter which takes the redstone signal as input on the 'red' redstone channel.

Redstone/Gunpowder is used in the following production stage(s):

- Rocket Fuel

The following machinery is used during this production stage:

- Refer to Section 17.5.

18.1. Description

During this stage of production, Redstone/Gunpowder is collected from a mob farm. This is the main supplier of Redstone/Gunpowder for the Rocket Fuel production stage. It is capable of meeting the Rocket Fuel production stage's supply demand of Gunpowder with four (4) Creeper Powered Spawners. Together with the Redstone-Growing production stage and this stage's eleven (11) Witch Powered Spawners, the production capacity of Redstone is sufficient to reach the supply demand of Redstone for the Rocket Fuel production stage.

If this stage cannot meet the supply demand of Redstone, then a Redstone signal will be emitted using a ME Level Emitter, as described in step 5 of the production process above.

18.2. Flow Charts

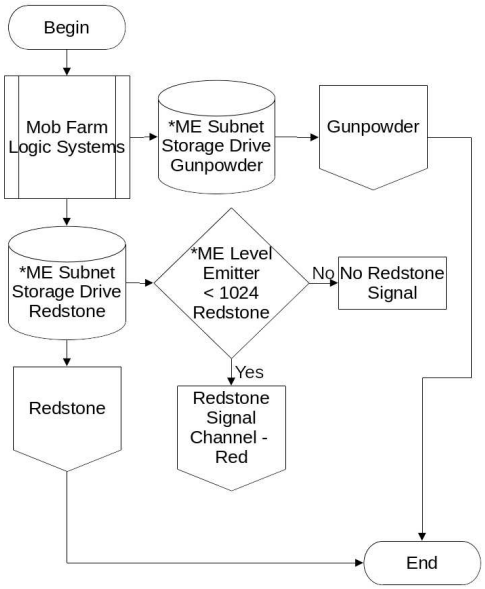
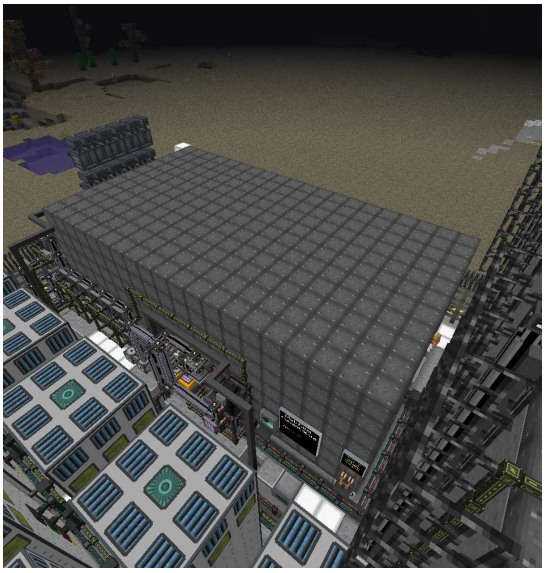


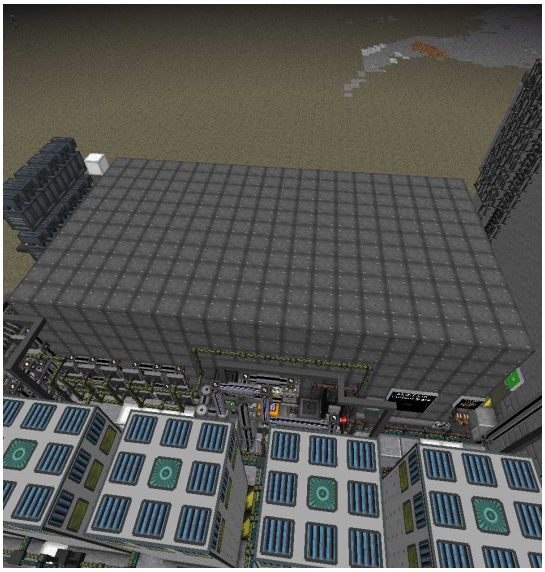
Figure 18-1. Redstone and Gunpowder Production Diagram.

18.3. Setup Photos

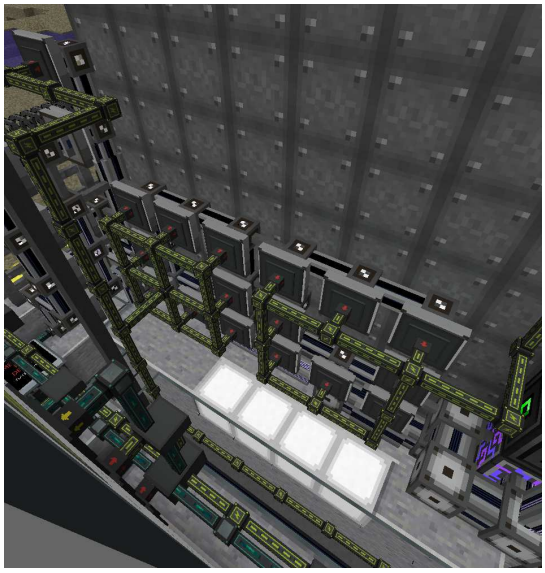
Photograph 18-1-1. Redstone and Gunpowder production systems, ground view.



Photograph 18-1-2. Redstone and Gunpowder production systems, aerial view.



Photograph 18-1-3. Redstone and Gunpowder production systems, alternate aerial view.



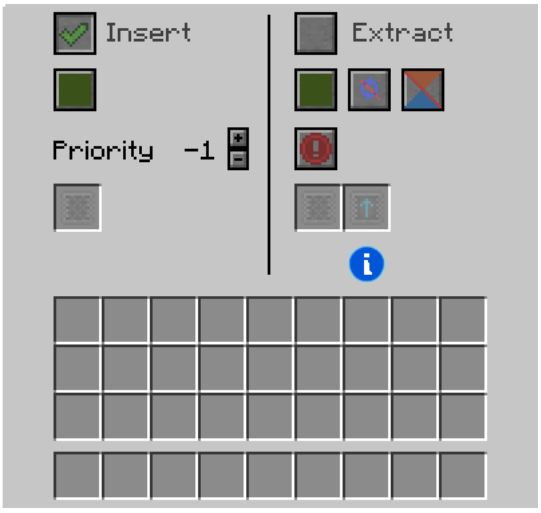
Photograph 18-1-4. Power Input/Output buses; FE-configured P2P Tunnels.

Photograph 18-2. Redstone buffer chest (top), and Gunpowder buffer chest (bottom).

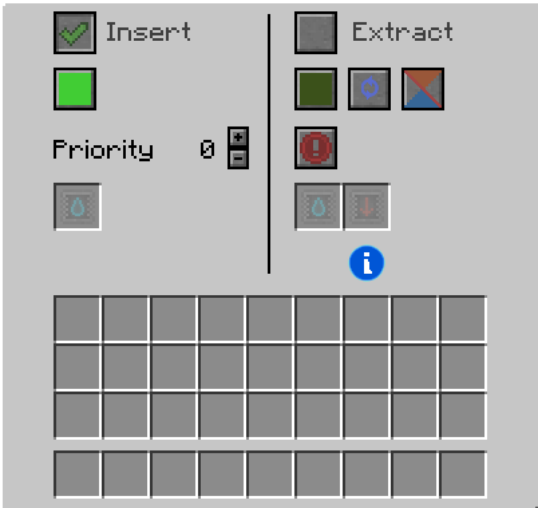
Photograph 18-3. Redstone product export systems (left), and Gunpowder product export systems (right).

Configuration 18-1-1. Nullifier Redstone Control configuration.

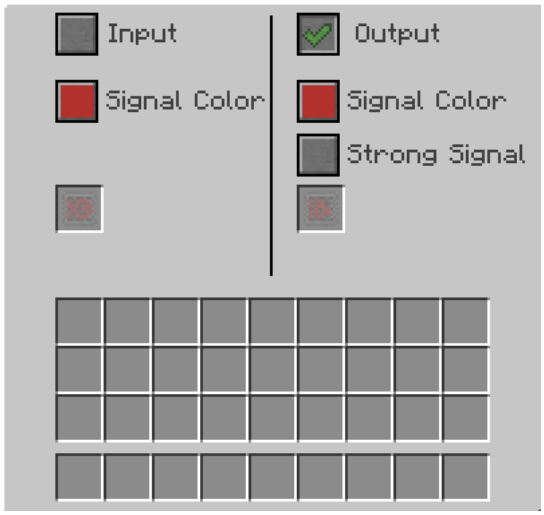
Configuration 18-1-2. Nullifier Input/Output side configuration.



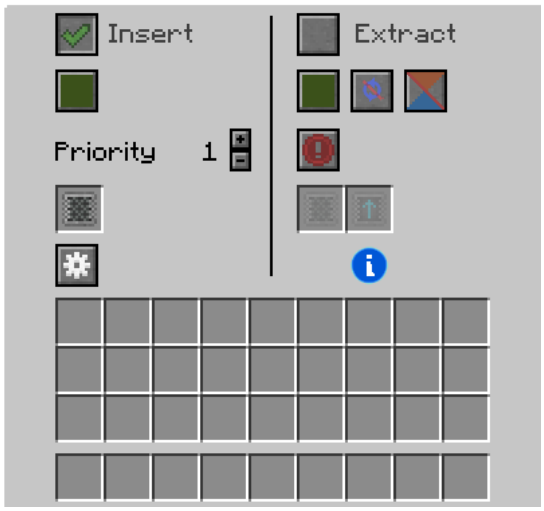
Configuration 18-1-3. Item Conduit configuration for Nullifier.



Configuration 18-1-4. Fluid Conduit configuration for Nullifier.

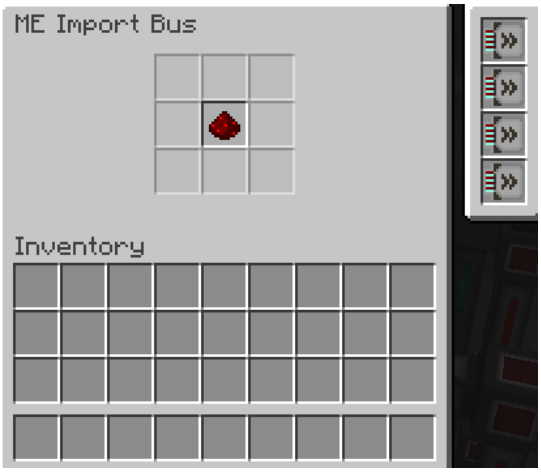


Configuration 18-1-5. Redstone Conduit configuration for Nullifier.

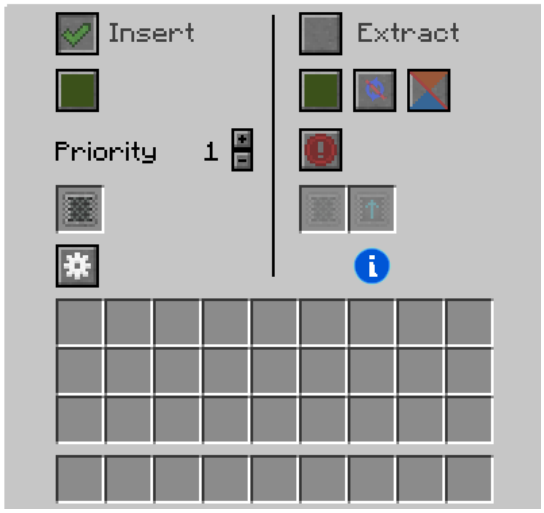


Configuration 18-2-1. Item Conduit configuration for Redstone buffer chest.

Configuration 18-2-2. Item Conduit insert filter configuration for Redstone buffer chest.

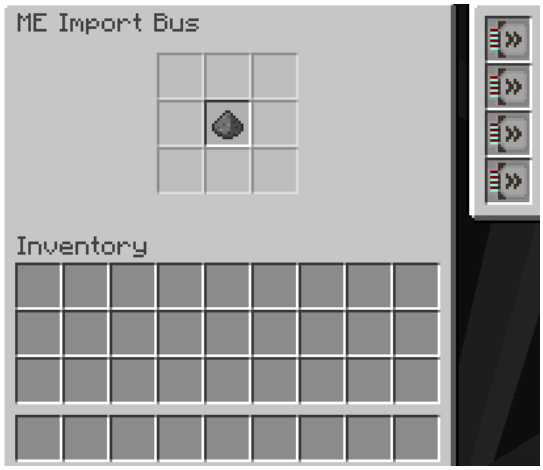


Configuration 18-2-3. ME Import Bus configuration for Redstone buffer chest.

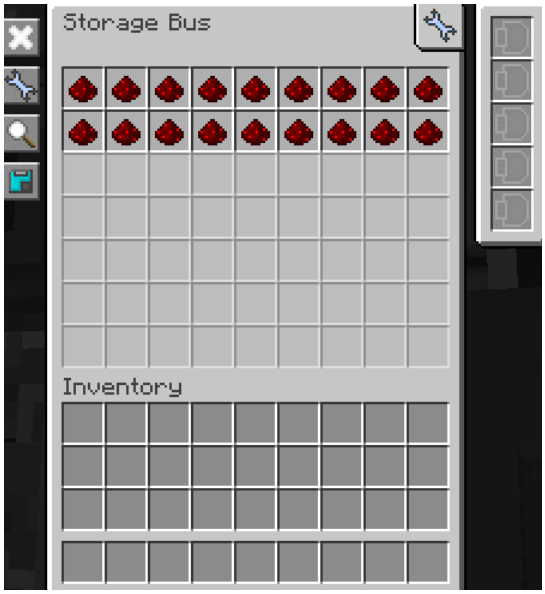


Configuration 18-3-1. Item Conduit configuration for Gunpowder buffer chest.

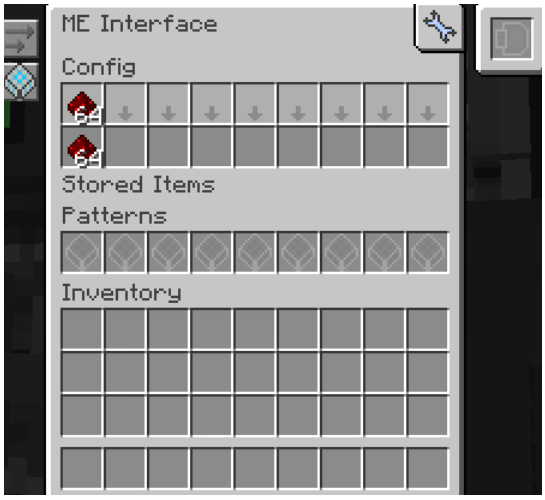
Configuration 18-3-2. Item Conduit insert filter configuration for Gunpowder buffer chest.



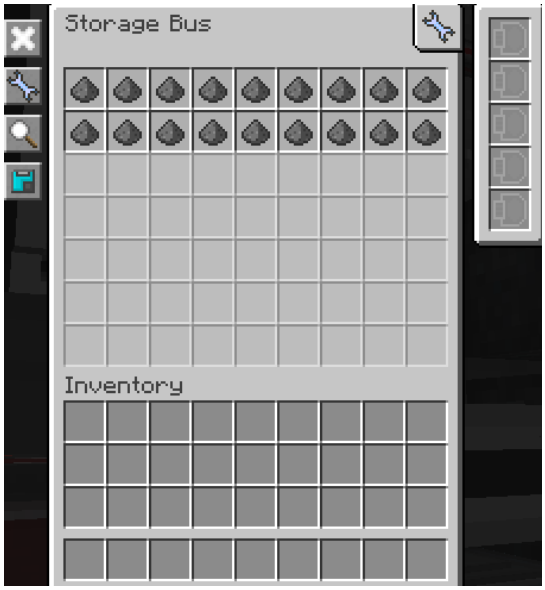
Configuration 18-3-3. ME Import Bus configuration for Gunpowder buffer chest.



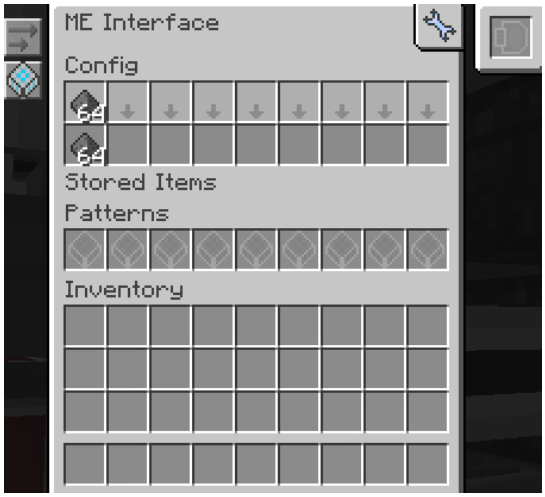
Configuration 18-4-1. Product - Redstone - ME Storage Bus



Configuration 18-4-2. Product - Redstone - ME Interface



Configuration 18-5-1. Product - Gunpowder - ME Storage Bus



Configuration 18-5-2. Product - Gunpowder - ME Interface

19. Hootch

The sixteenth stage of the production process involves producing Hootch (alcohol). The following is an outline of the production process:

1 Enhanced Vats take Sugar, Potatoes, and Water to produce Hootch.

2 Hootch is then inserted into the Hootch buffer chest.

3 Hootch within the Hootch buffer chest is imported and stored in the AE production network.

Hootch is used in the following production stage(s):

- Rocket Fuel

The following machinery is used during this production process:

- The Enhanced Vat - Ender IO

19.1. Description

This production stage creates one of three primary components for the production of Rocket Fuel. The amount of Hootch-producing Enhanced Vats MUST be greater-than or equal to the amount of Rocket Fuel-producing Enhanced Vats. As the rate of production for both are the same. Additionally, Hootch-producing Enhanced Vats SHOULD use Octadic Capacitors when possible. The same type of capacitors MUST be used in the Rocket Fuel-producing Enhanced Vats.

19.2. Flow Charts

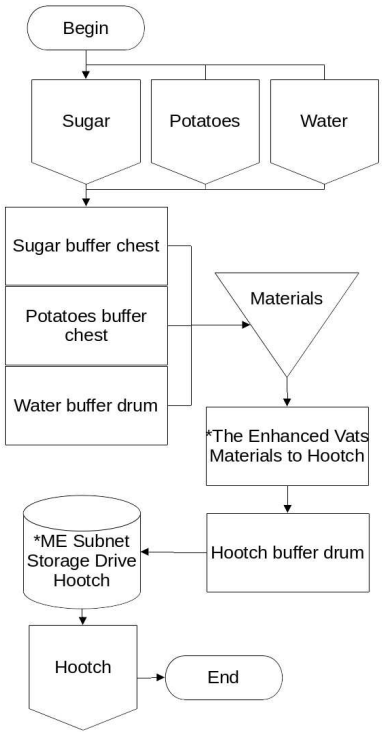
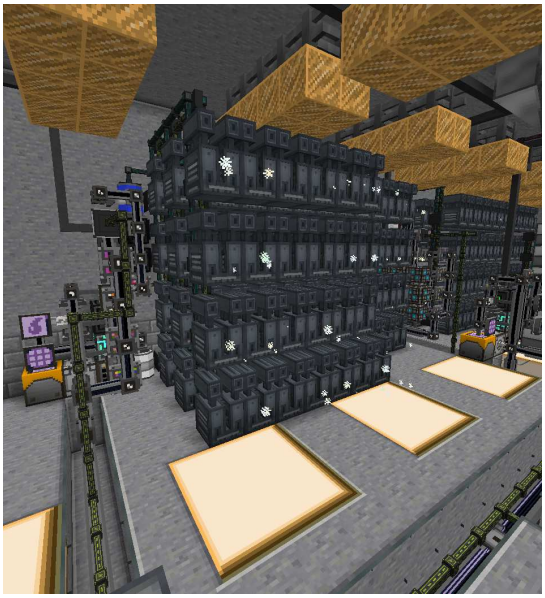


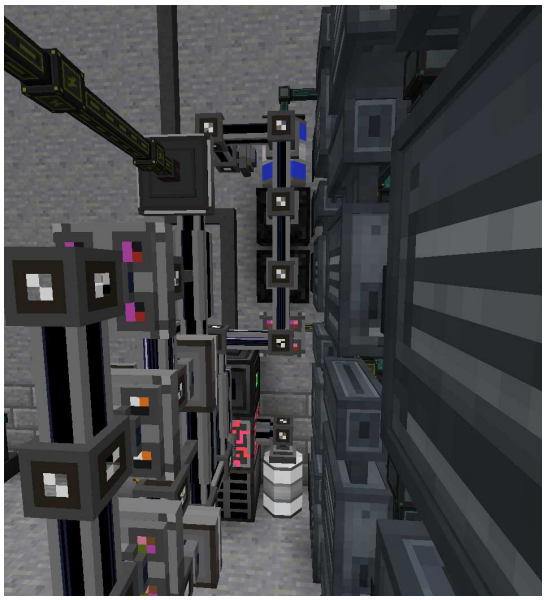
Figure 19-1. Hootch Production Diagram.

19.3. Setup Photos

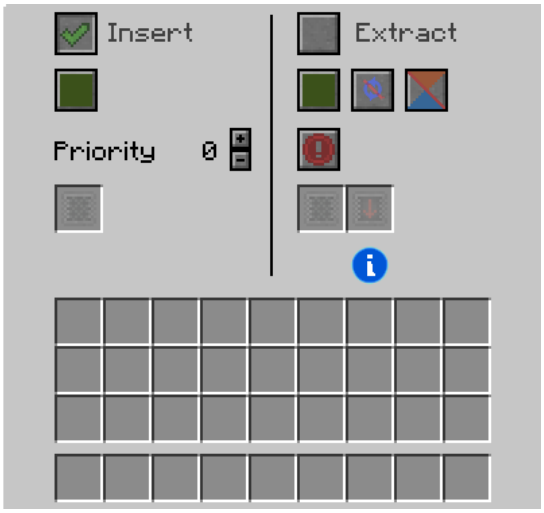


Photograph 19-1. Hootch production systems

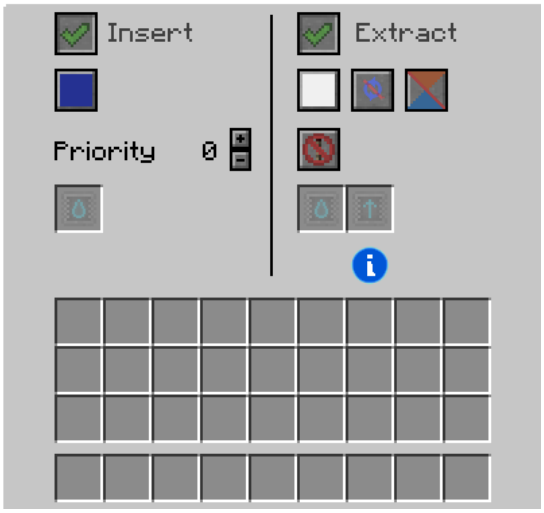
Photograph 19-2. Resource Provision Systems; The first two P2P Tunnels starting from the top provide Water, the third P2P Tunnel from the top provides Potatoes, the fourth P2P Tunnel from the top provides Sugar.



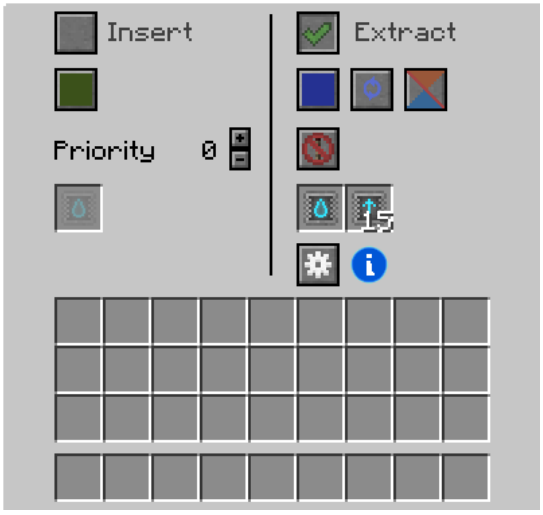
Photograph 19-3. Water buffer drum (top), Potatoes buffer chest (second from top), Sugar (third from top), Hootch buffer drum (fourth from top).



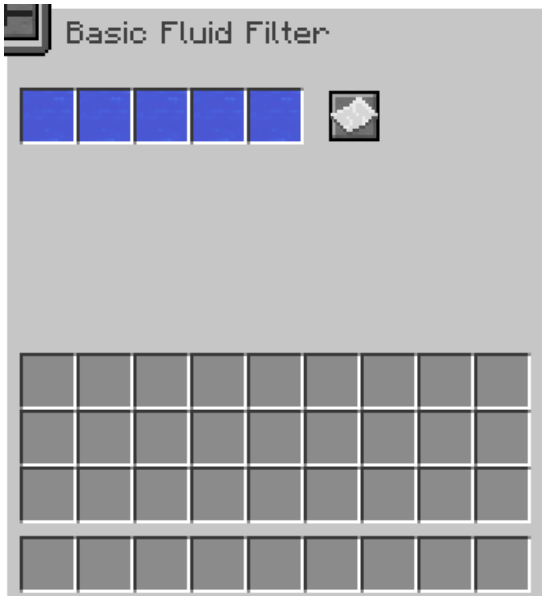
Configuration 19-1-1. Item Conduit configuration for The Enhanced Vats.



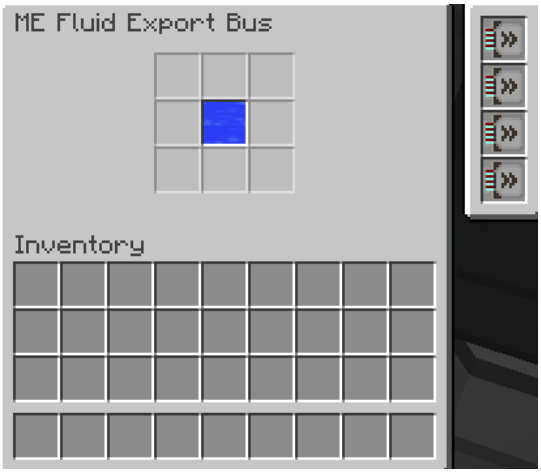
Configuration 19-1-2. Fluid Conduit configuration for The Enhanced Vats.



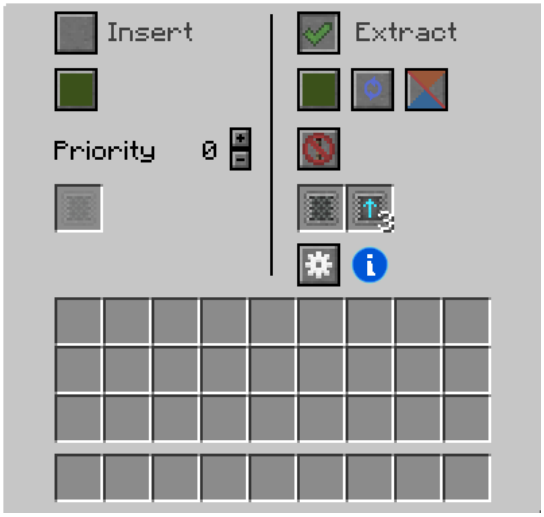
Configuration 19-2-1. Fluid Conduit configuration for Water buffer drum.



Configuration 19-2-2. Fluid Conduit extract filter configuration for Water buffer drum.



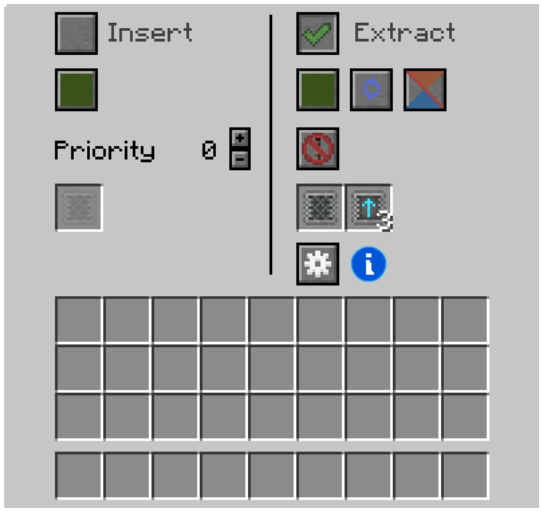
Configuration 19-2-3. ME Fluid Export Bus configuration for Water buffer drum.



Configuration 19-3-1. Item Conduit configuration for Potatoes buffer chest.

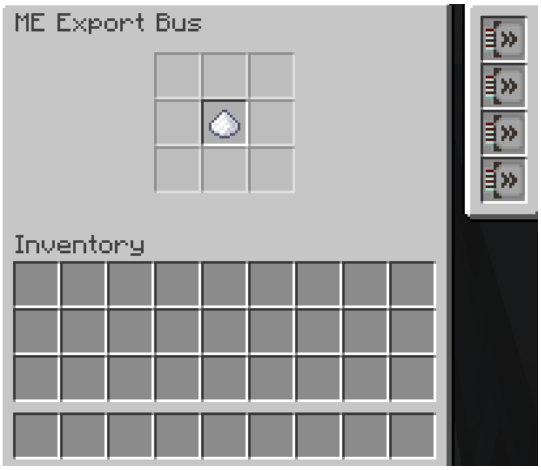
Configuration 19-3-2. Item Conduit extract filter configuration for Potatoes buffer chest.

Configuration 19-3-3. ME Export Bus configuration for Potatoes buffer chest.

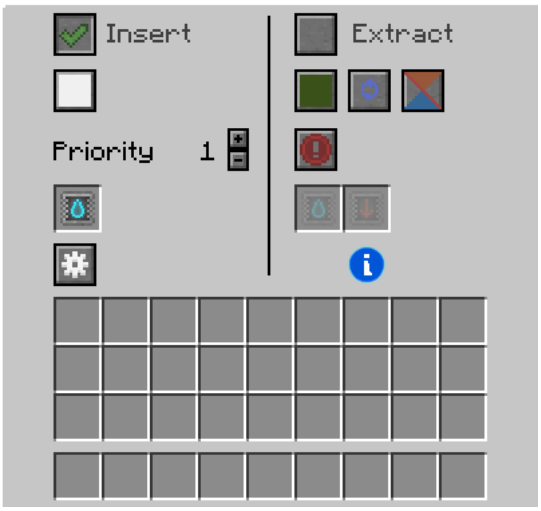


Configuration 19-4-1. Item Conduit configuration for Sugar buffer chest.

Configuration 19-4-2. Item Conduit extract filter configuration for Sugar buffer chest.

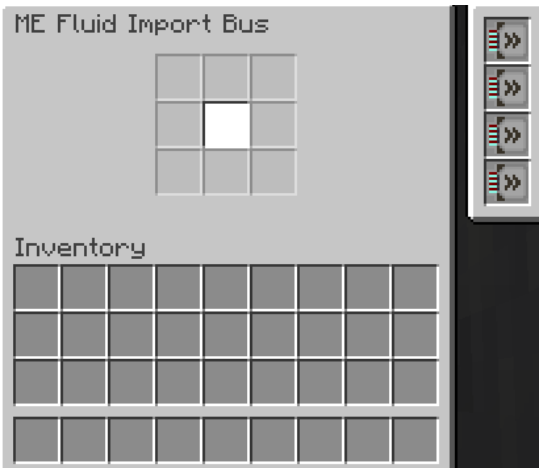


Configuration 19-4-3. ME Export Bus configuration for Sugar buffer chest.

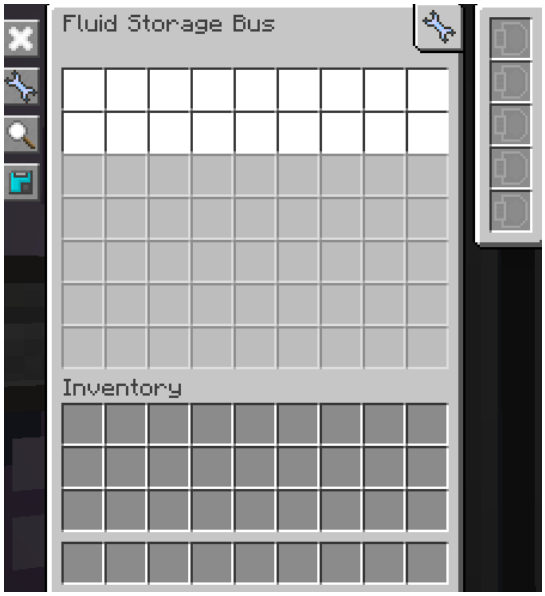


Configuration 19-5-1. Fluid Conduit configuration for Hootch buffer drum.

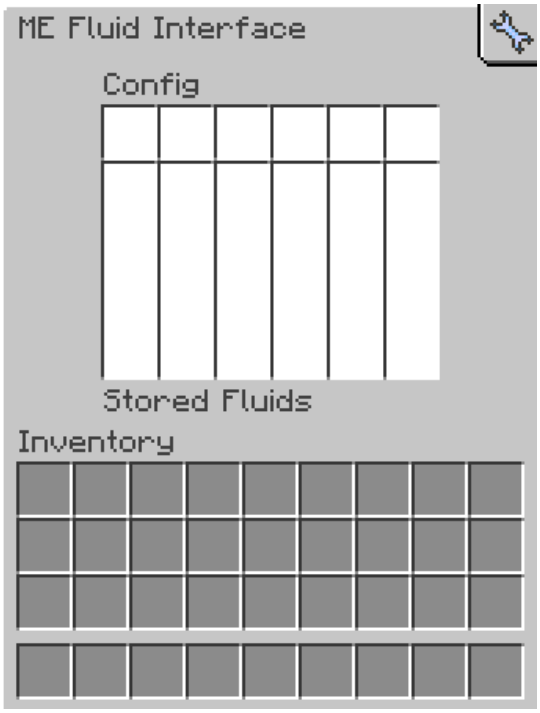
Configuration 19-5-2. Fluid Conduit insert filter configuration for Hootch buffer drum.



Configuration 19-5-3. ME Fluid Import Bus configuration for Hootch buffer drum.



Configuration 19-6-1. Product - Hootch - ME Fluid Storage Bus



Configuration 19-6-2. Product - Hootch - ME Fluid Interface

20. Rocket Fuel

The seventeenth (and last) stage of the production process involves producing Rocket Fuel. The following is an outline of the production process:

1 Enhanced Vats take Redstone, Gunpowder, and Hootch to produce Rocket Fuel.

2 Rocket Fuel is then inserted into the Rocket Fuel buffer drum.

3 Rocket Fuel within the Rocket Fuel buffer drum is imported and stored within the AE production network.

4 During operation, the Rocket Fuel Production Vats PLC can disable half of the Rocket Fuel production vats if the amount of Redstone in the: Redstone and Gunpowder, and Redstone-Growing production stages both fall below one-thousand twenty four (1024).

Rocket Fuel is used in the following production stage(s):

- None, end of production process.

The following machinery is used during this production stage:

- Processor - RFTools Control
- The Enhanced Vat - Ender IO

20.1. Description

This production stage takes Redstone, Gunpowder, and Hootch to produce Rocket Fuel. The Enhanced Vats in this stage MUST use the same capacitors used in the Hootch Enhanced Vats from the previous stage.

20.1.1. Rocket Fuel Production Vats PLC

The Rocket Fuel production stage uses a Processor to toggle on/off half of the Rocket Fuel production vats using a redstone signal provided on the white redstone channel. This redstone signal is transferred using Redstone Conduits, as shown in Photograph 20-6-2. The processor takes redstone signals from the: Redstone and Gunpowder (Red redstone channel), and Redstone-Growing (Green redstone channel) production stages, as shown in Photograph 20-5-1 and Photograph 20-5-2 respectively. A Redstone Conduit, equipped with a Redstone AND Filter connects to the processor, and will output a redstone signal on the white redstone channel, as shown in Photograph 20-6-1. Because of the Redstone AND Filter, both the Red and Green redstone channels are required to be active for a redstone signal to be outputted to the Processor. Since a Redstone AND Filter is used, the redstone signal to the Processor will stop being emitted when one of the previously mentioned production stages stops supplying their respective redstone signal. When this occurs the Processor will wait 1200 ticks (1 minute) before re-enabling half of the Rocket Fuel production vats.

This system is used because it is possible that at some point during operation the: Redstone and Gunpowder, and Redstone-Growing production stages will not have enough Redstone to continue production, which would put them into the STALL Operation State. To prevent this, half of the Rocket Fuel production vats are disabled so both the aforementioned production stages have a chance to produce Redstone without a net-loss. While half of the Rocket Fuel production vats are disabled, the Rocket Fuel production stage is put into the REDUCED Operation State.

Unlike previous stages, this stage uses a Quantum Network Bridge to share Rocket Fuel with an off-site location, see Section 21.

20.2. Operating State Advisory

What follows is a list of one or more Operation States that modify this production system's physical/logical behavior, along with the specific systems modified:

- REDUCED - When this production system is put into this state: half of the Rocket Fuel production vats are disabled via a redstone signal.

20.3. Flow Charts

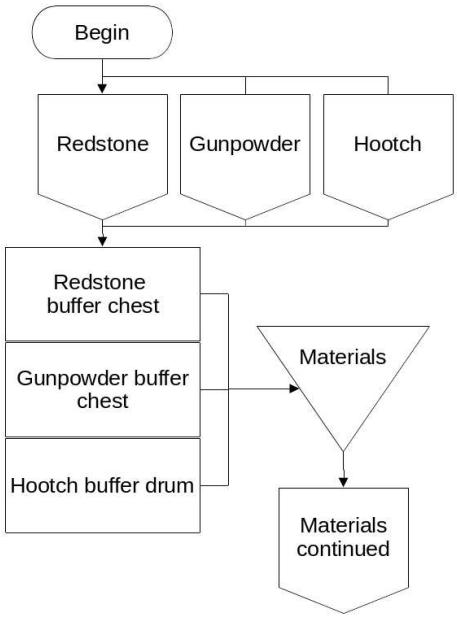


Figure 20-1-1. Rocket Fuel Production Diagram

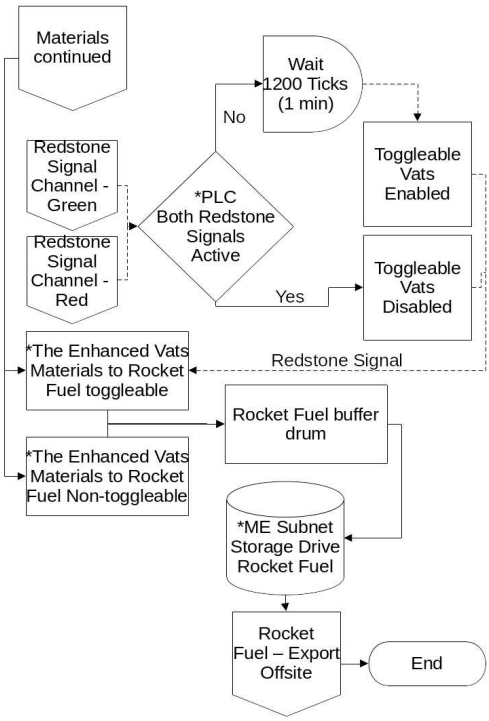
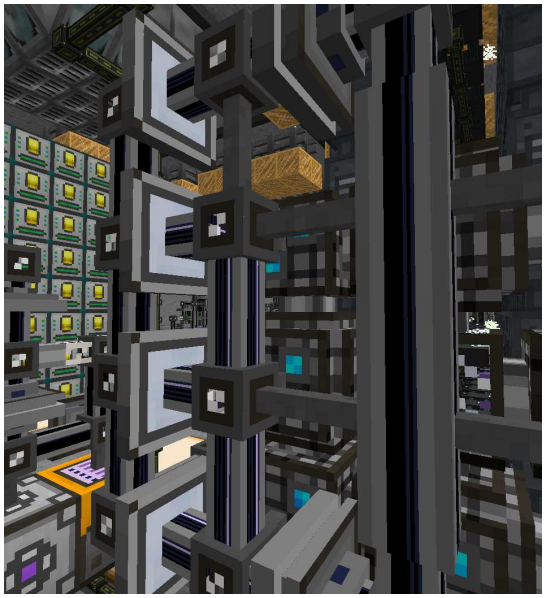


Figure 20-1-2. Rocket Fuel Production Diagram continued

20.4. Setup Photos

Photograph 20-1. Rocket Fuel production systems



Photograph 20-2. Resource Provision Systems; P2P Tunnel (top) provides Hootch, P2P Tunnel (second from top) provides Gunpowder, the last two P2P Tunnels provide Redstone.

Photograph 20-3. Hootch buffer drum (top), Redstone buffer chest (second from top), Gunpowder buffer chest (third from top), Rocket Fuel buffer drum (fourth from top).

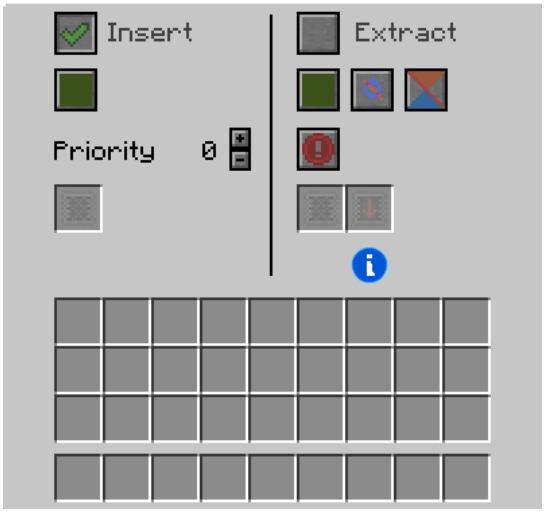
Photograph 20-4. The Rocket Fuel production PLC (bottom) and Dimensional Transceiver (top).

Photograph 20-5-1. Red redstone channel and ME Level Emitter on the Redstone and Gunpowder production stage.

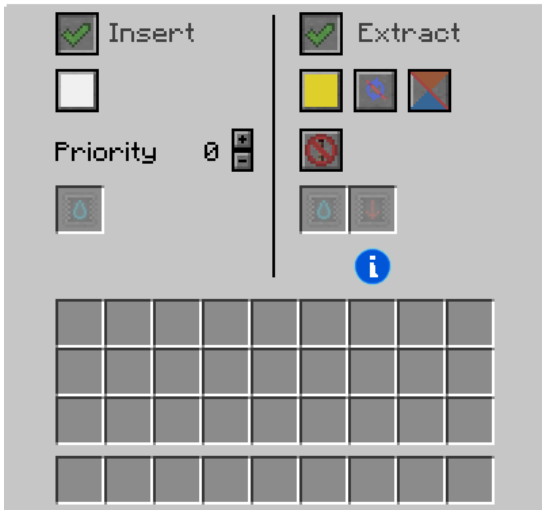
Photograph 20-5-2. Green redstone channel and ME Level Emitter on the Redstone-Growing production stage.

Photograph 20-6-2. A Redstone Conduit coming from the Processor transports a redstone signal on the white redstone channel to half of the Rocket Fuel production vats.

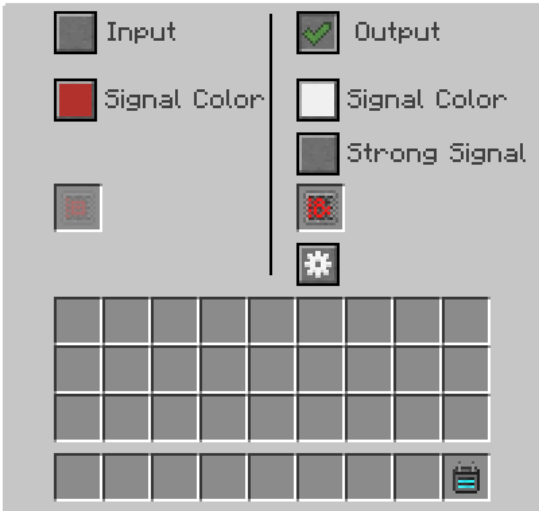
Photograph 20-6-1. A Redstone Conduit using a Redstone AND Filter, is configured to output a redstone signal on the white redstone channel to the Processor if both the Red and Green redstone channels are active.



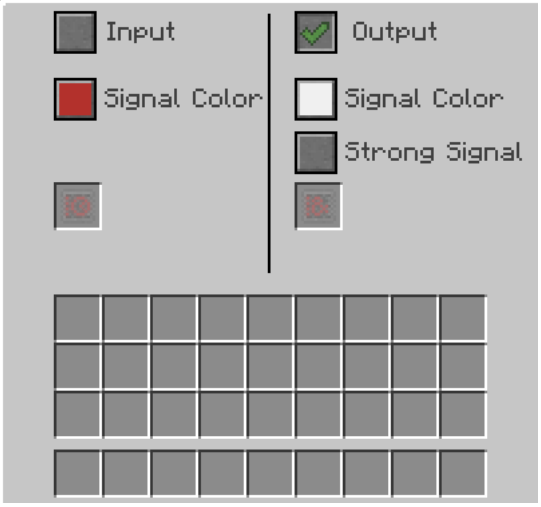
Configuration 20-1-1. Item Conduit configuration for The Enhanced Vats.



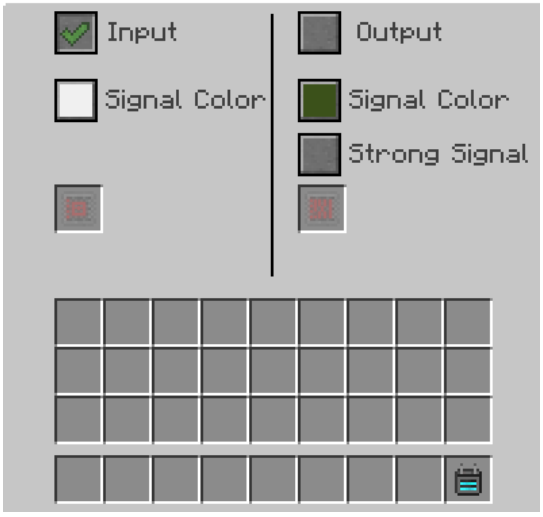
Configuration 20-1-2. Fluid Conduit configuration for The Enhanced Vats.



Configuration 20-2-1. Redstone Conduit output configuration for the Processor.

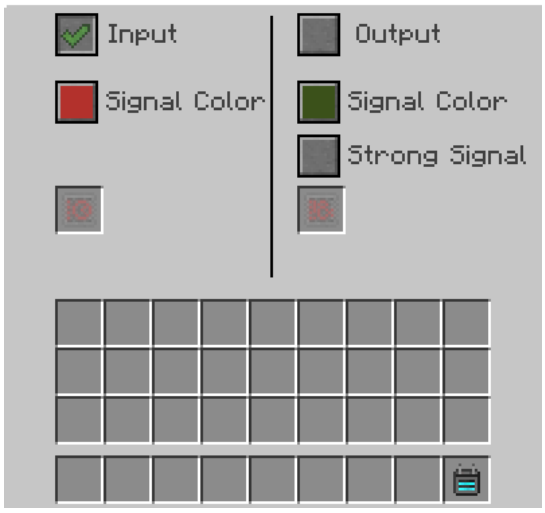


Configuration 20-1-3. Redstone Conduit configuration for The Enhanced Vats.



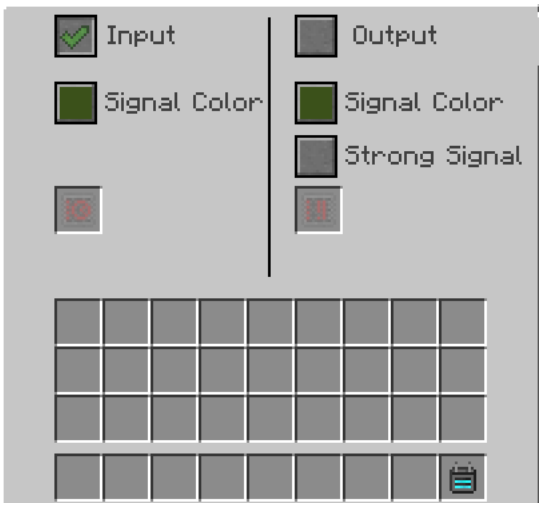
Configuration 20-2-2. Redstone Conduit input configuration for the Processor.

Configuration 20-2-3. Redstone Conduit Redstone AND Filter configuration for the Processor.



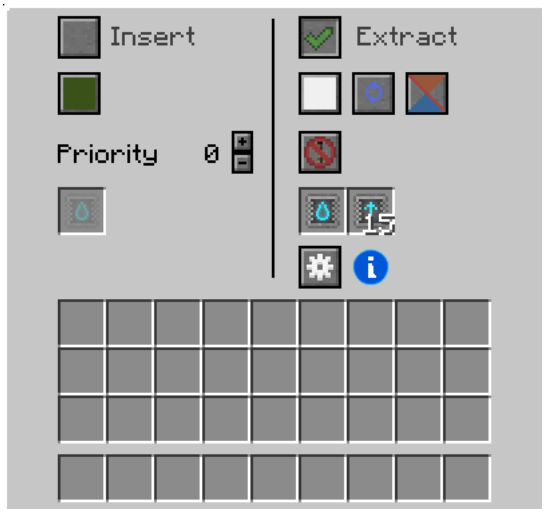
Configuration 20-2-4. Red redstone channel - Redstone Conduit configuration.

Configuration 20-2-5. Red redstone channel - ME Level Emitter configuration.



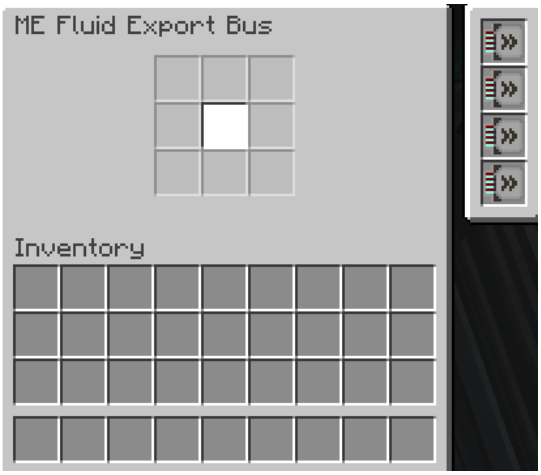
Configuration 20-2-6. Green redstone channel - Redstone Conduit configuration.

Configuration 20-2-7. Green redstone channel - ME Level Emitter configuration.

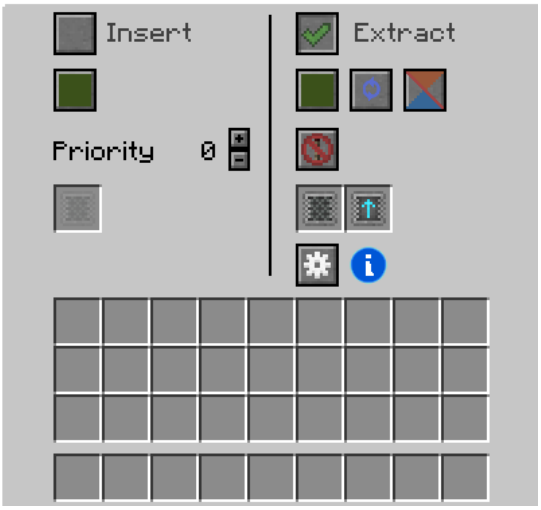


Configuration 20-3-1. Fluid Conduit configuration for Hootch buffer drum.

Configuration 20-3-2. Fluid Conduit extract filter configuration for Hootch buffer drum.

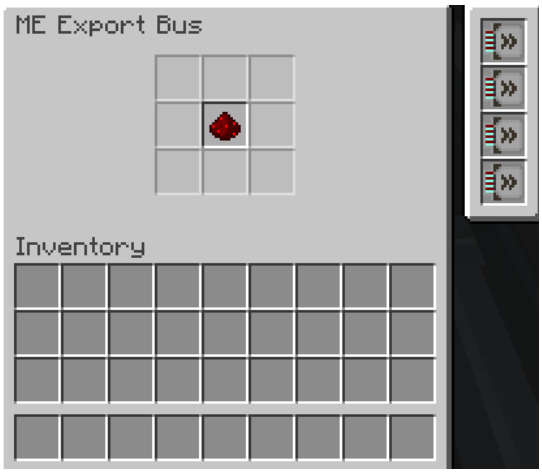


Configuration 20-3-3. ME Fluid Export Bus configuration for Hootch buffer drum.

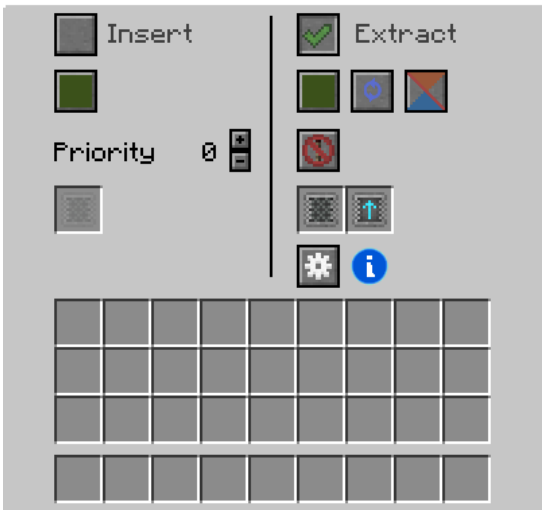


Configuration 20-4-1. Item Conduit configuration for Redstone buffer chest.

Configuration 20-4-2. Item Conduit extract filter configuration for Redstone buffer chest.

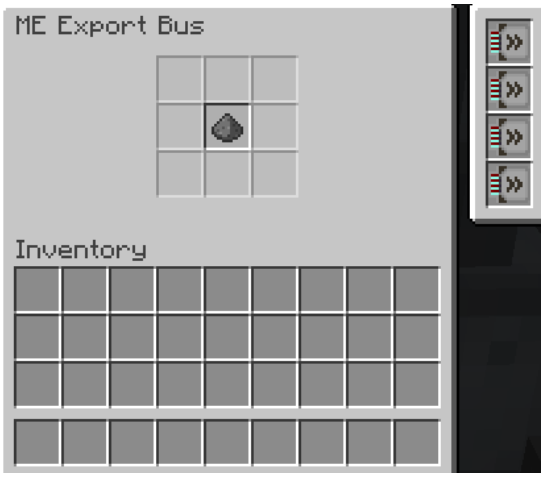


Configuration 20-4-3. ME Export Bus configuration for Redstone buffer chest.

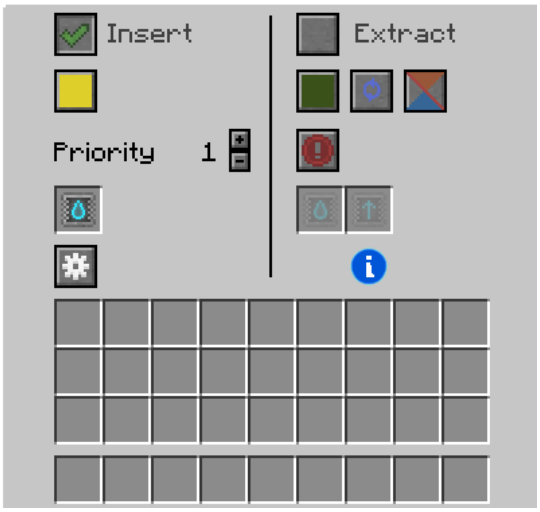


Configuration 20-5-1. Item Conduit configuration for Gunpowder buffer chest.

Configuration 20-5-2. Item Conduit extract filter configuration for Gunpowder buffer chest.

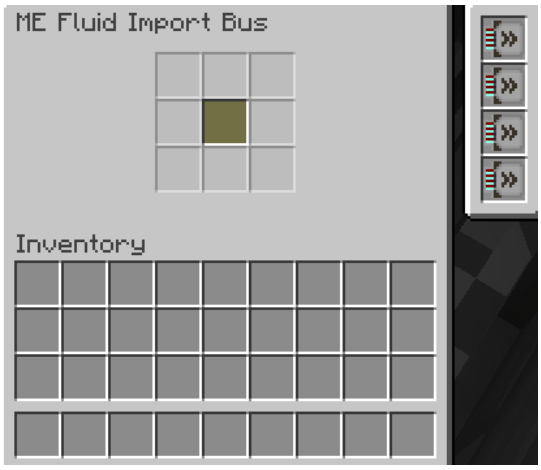


Configuration 20-5-3. ME Export Bus configuration for Gunpowder buffer chest.



Configuration 20-6-1. Fluid Conduit configuration for Rocket Fuel buffer drum.

Configuration 20-6-2. Fluid Conduit insert filter configuration for Rocket Fuel buffer drum.



Configuration 20-6-3. ME Fluid Import Bus configuration for Rocket Fuel buffer drum.

21. Exporting Rocket Fuel Off-Site

To export Rocket Fuel off-site, a dedicated AE2 subnetwork is used (hereafter referred to as the 'export network'). The export network is a subnetwork of the Rocket Fuel production system's AE2 network (hereafter referred to as the 'Rocket Fuel AE2 network').

The export network consists of the following components:

- Energy Acceptor (1x) - Applied Energistics 2
- ME Controller (1x) - Applied Energistics 2

- ME Fluid Interface (1x) - Applied Energistics 2
- ME Fluid Storage Bus (1x) - Applied Energistics 2
- ME Inverted Toggle Bus (1x) - Applied Energistics 2
- ME Security Terminal (1x) - Applied Energistics 2
- Quantum Entangled Singularity (2x; i.e., a pair) - Applied Energistics 2
- Quantum Network Bridge (2x) - Applied Energistics 2

21.1. On-Site Export Network Setup Requirements

The on-site portion of the export network MUST use all the aforementioned components, with two (2) exceptions: (1) only use one of the two Quantum Network Bridges, and (2) only use one of the two Quantum Entangled Singularities. The on-site export network MUST have functionally the same logical configuration as shown in Figure 21-1. The on-site export network SHOULD have the identical physical configuration shown in Photograph 21-1, deviation from the physical configuration is acceptable as long as the logical configuration remains consistent with what is shown in Figure 21-1. The on-site export network MUST be separated from the Rocket Fuel AE2 network using Cable Anchors. These Cable Anchors are to be present on every segment of cable which can connect to the export network as shown in Photograph 21-1.

In order to isolate the on-site export network from the Rocket Fuel AE2 network: the Rocket Fuel AE2 network provides an ME Fluid Interface, then the export network attaches its ME Fluid Storage Bus to the Rocket Fuel AE2 network's ME Fluid Interface. In this configuration, the two networks are now isolated from one another, the export network will only have access to Rocket Fuel and nothing else, additionally the export network will not know the actual amount of Rocket Fuel stored in the Rocket Fuel AE2 network, the export network will display however much Rocket Fuel the ME Fluid Interface is configured to keep buffered. To see this setup logically, refer to Figure 21-1.

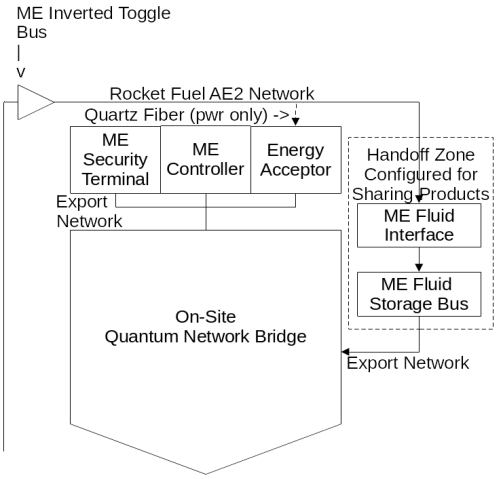
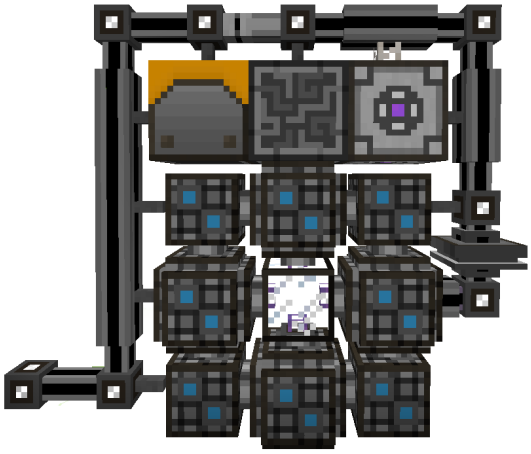
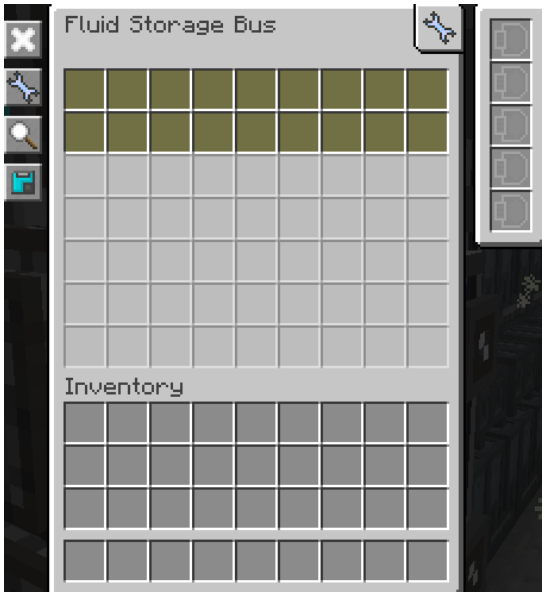


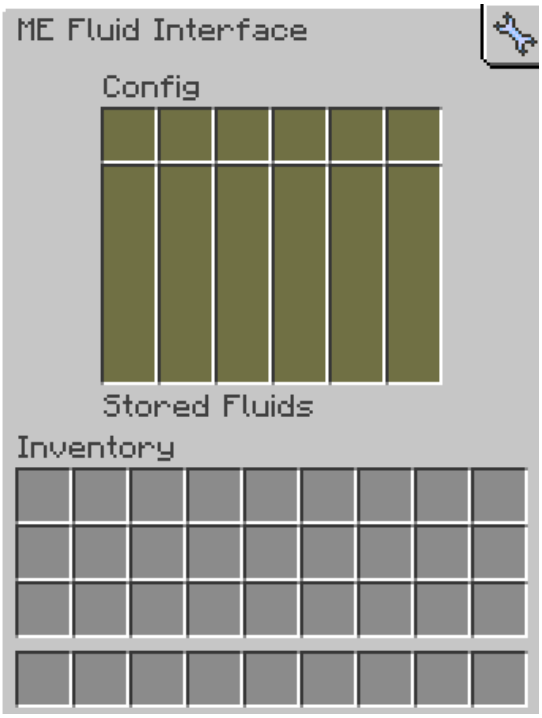
Figure 21-1. Logical network configuration of the on-site export network.



Photograph 21-1. Physical configuration of the on-site export network.



Configuration 21-1-1. Product - Rocket Fuel - ME Fluid Storage Bus



Configuration 21-1-2. Product - Rocket Fuel - ME Fluid Interface

21.2. Off-Site Export Network Setup Requirements

The off-site portion of the export network requires a Quantum Network Bridge, and the corresponding Quantum Entangled Singularity from the on-site export network.

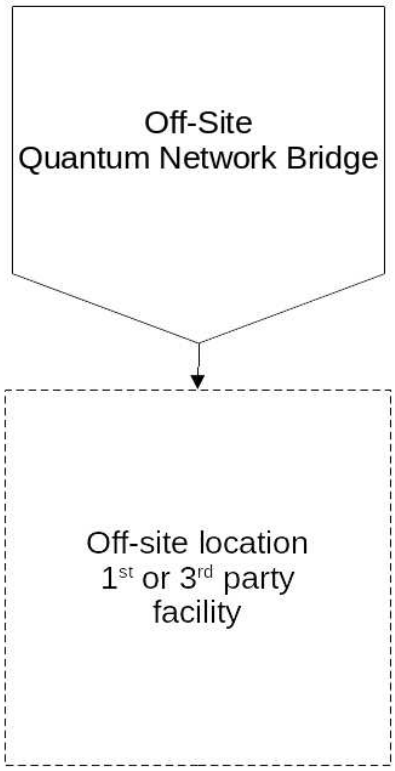
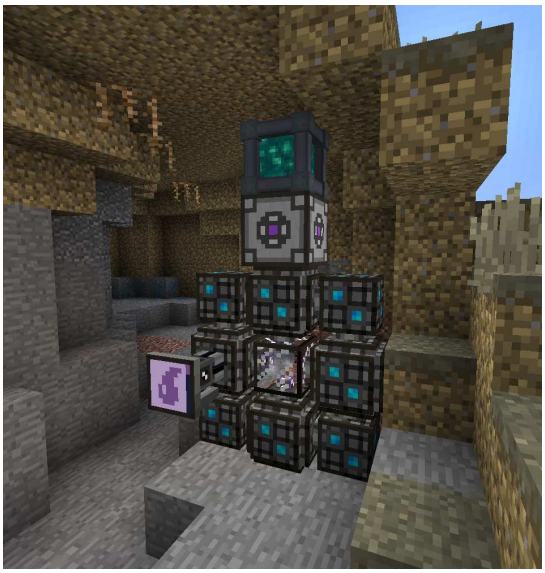


Figure 21-2. Logical network configuration of the off-site export network.



Photograph 21-2. Physical configuration of the off-site export network.

21.3. Requirements for Power Delivery to Export Networks

The off-site export network MUST NOT be connected to any off-site energy grid. Instead use a pair of Dimensional Transceivers (or any other

device which can transfer energy over large distances and between dimensions). The first Dimensional Transceiver is receiving energy from the Rocket Fuel production system (Photograph 21-3-1), the second Dimensional Transceiver is supplying energy to the off-site export network (Photograph 21-3-2).

Photograph 21-3-1. On-site Dimensional Transceiver sending energy from the Rocket Fuel production system to the off-site Dimensional Transceiver.

Photograph 21-3-2. Off-site Dimensional Transceiver (top) sending energy from the on-site Dimensional Transceiver to the off-site export network.

21.3.1. Avoiding an Energy Loop

The reason not to use an off-site energy grid is because energy transfer between all Applied Energistics 2 devices, including Quantum Network Bridges, is bi-directional. The result is the off-site energy grid supplying energy to all production systems. This happens because the on-site export network is connected to the Rocket Fuel AE2 Network (via a Quartz Fiber Cable), facilitating energy transfer between the two networks, and the Rocket Fuel AE2 Network is connected to the transport network (via a Quartz Fiber Cable), which again allows energy to transfer between themselves, resulting in all production systems being powered by the off-site energy grid.

Even in the required setup above (i.e. using only energy generated on-site), an energy 'loop' still occurs because of the configuration of both export networks, and the nature of Applied Energistics 2 devices. This energy loop will prevent the immediate loss of power in all production systems, as energy will be drawn from the Dimensional Transceivers' internal energy buffers. This introduces unexpected behavior into the entire process (across all production systems), and so it must be addressed.

To avoid an energy loop, an ME Inverted Toggle Bus (specifically because in Direwolf20 1.12 v2.8.0. the ME Toggle Bus is bugged and does not operate correctly, all AE devices on the same network as an ME Toggle Bus will become offline when a redstone signal is applied to the ME Toggle Bus) is installed on the Rocket Fuel AE2 Network as shown in Photograph 21-1. Then to isolate the on-site export network from the Rocket Fuel AE2 Network, supply a redstone signal to the ME Inverted Toggle Bus.

21.4. Chunkloading Requirements

Lastly, at least one portion of the export network MUST be reliably chunkloaded using FTB-Utilities-Chunks or some other plugin. If both portions of the export network rely on a physical chunk loader (such as the one provided by the ChickenChunks mod) then some instabilities with the Quantum Network Bridges will be introduced. Such instabilities can crash the game.

22. Defensive Systems

The following subsections define varying types of defense systems which operate in the network and physical space.

22.1. Network Defense Systems

A Network Defense System (NDS) is a type of system that provides security capabilities to a network. This can be in the form of: access controls, firewalls, white/black lists, etc. Typically these systems will prevent: access to network resources, and logical/physical modification of the network and its devices.

There are two (2) types of NDSs: Applied Energistics 2's ME Security Terminal, and RFTool's Security Card/Security Manager. The ME Security Terminal provides access control and network/physical security to Applied Energistics 2 networks, while the RFTool's Security Card and Security Manager provide similar security capabilities for RFTools, RFTools Control, and XNet networks/devices.

The following table specifies the capabilities that the two security systems provide:

NDS	Capabilities
ME Security Terminal	Deposit - Add items to storage Withdraw - Remove items from storage Craft - Initiate crafting jobs Build - Modify physical network/modify network device configurations Security - Access security terminal
Security Card/ Security Manager	Prevent GUI access

Table 22-1. Capabilities of Network Defense Systems.

22.1.1. ME Security Terminal

An ME Security Terminal "enforces permissions on the usage of the [AE] system".[4] To define permissions for every player (excluding the player who initially placed the ME Security Terminal), insert a blank Biometric Card into the ME Security Terminal. This Biometric Card WILL NOT be given any permissions, and thus nobody will have permissions on the AE network.

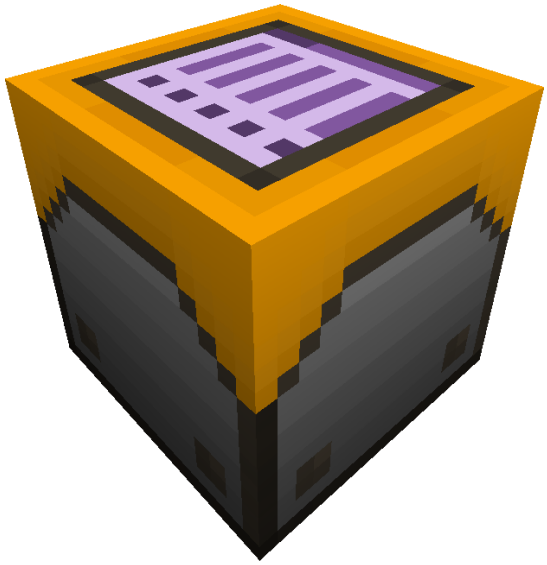


Figure 22-1-1. An ME Security Terminal

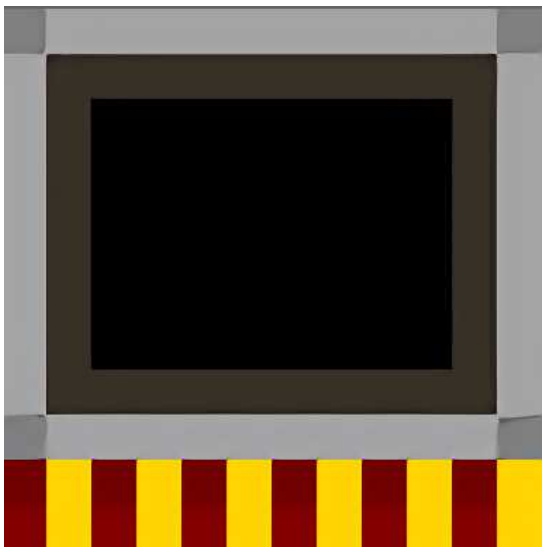


Figure 22-1-2. A blank Biometric Card

22.1.2. Security Card/Security Manager

The RFTools Security Card is used to link RFTools, RFTools Control, and XNet devices to a security channel. By doing so it enforces who is allowed to interact with the device via a white/black list. The Security Card is configured by placing it in the top-left slot of the Security Manager. The Security Card can then be given a channel name, and the white/black list can be configured. Whenever the configuration of the Security Card changes, that change is reflected across all devices linked with that Security Card. A Security Card must first be configured in the Security Manager before it can be used to link machines to a security channel.

Figure 22-2-1. A Security Manager

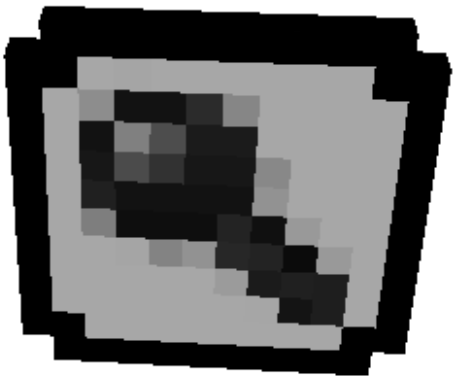


Figure 22-2-2. A Security Card

22.2. Environmental Defense Systems

An Environmental Defense System (EDS) is a type of system that can: apply a status effect (invisibility, night-vision, poison, hunger, etc...), and/or allow/disallow certain actions within a given area. An EDS may give some type of advantage to authorized individuals (such as regeneration, resistance, ability to break/interact with objects), and/or some type of disadvantage to non-authorized individuals (such as slowness, weakness, inability to break/interact with objects).

There are two (2) classes of EDSs, active and passive. An Active-EDS is some type of device. While a Passive-EDS is applied by the environment itself (such as the various boss strongholds and biomes in the Twilight Forest) without any interaction by the player.

22.2.1. Active-Environmental Defense Systems

There are three types of Active-EDSs: Ender IO's Aversion Obelisk, Ender IO's Inhibitor Obelisk, and RFTool's Environmental Controller. Note that other mods provide devices with similar functionality, however those are not in the scope of this document.

The following table specifies the capabilities that the three Active-EDSs provide:

Active-EDS	Capabilities
Aversion Obelisk	Prevent mob spawning
Inhibitor Obelisk	Prevent teleportation
Environmental Controller	Applies one or more status effects via various Environmental Modules

Table 22-2. Capabilities of Active-Environmental Defense Systems.

22.2.1.1. Aversion Obelisk

An Aversion Obelisk selectively prevents mobs from spawning around it. Soul Vials containing the soul of a mob are placed inside of the Aversion Obelisk, this will make that mob not spawn within the area of effect.[5] The Aversion Obelisk has twelve (12) internal slots for soul vials. The radius of the effected area and power consumption are dependent upon the installed capacitor, as shown in Table 22-3.

Capacitor	Radius	Energy Usage
Basic Capacitor	32 meter radius (65x65 area)	80 µI/t
Double-Layer Capacitor	48 meter radius (97x97 area)	240 µI/t
Octadic Capacitor	80 meter radius (161x161 area)	720 µI/t

Table 22-3. Aversion Obelisk capacitor upgrades.

Figure 22-3-1. An Aversion Obelisk

Figure 22-3-2. An Inhibitor Obelisk

22.2.1.2. Inhibitor Obelisk

An Inhibitor Obelisk prevents teleportation within its area of effect. The radius of the effected area and power consumption are dependent upon the installed capacitor, as shown in Table 22-4.

Capacitor	Radius	Energy Usage
Basic Capacitor	16 meter radius (33x33 area)	20 µI/t
Double-Layer Capacitor	24 meter radius (49x49 area)	60 µI/t
Octadic Capacitor	40 meter radius (81x81 area)	180 µI/t

Table 22-4. Inhibitor Obelisk capacitor upgrades.

22.2.1.3. Environmental Controller

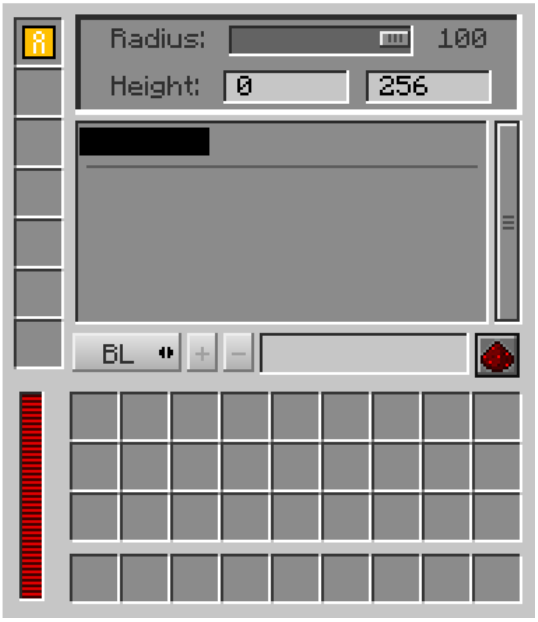
The Environmental Controller is capable of applying one or more status effects to: hostile mobs, passive mobs, players via a whitelist or blacklist, or all mobs and players at once. The Environmental Controller uses Environmental Modules to determine the status effect(s) to be applied, there are seven (7) internal slots for these Environmental Modules. There are Environmental Modules for every positive status effect (haste, regeneration, saturation, etc...), plus modules that: provide flight (Flight Environmental Module), prevent hostile mob spawns (Peaceful Environmental Module), and apply the Glowing status effect (Glowing Environmental Module). There are also modules that provide negative status effects (blindness, poison, weakness, etc...), however the default configuration make these modules only affect mobs, not players.

The Environmental Controller should be given one (1) Glowing Environmental Module. The Environmental Controller MUST be configured to use a blacklist, as shown in Configuration 22-1. This blacklist will contain a list of one or more authorized players who MUST NOT receive the Glowing status effect. Therefore, all players who receive the Glowing status effect are unauthorized. The Glowing status effect highlights the outline of an entity (in this case a player), this outline is visible even when obstructed (such as when underground, behind a wall, etc...) which makes it easy to notice.

Additionally, the Environmental Controller MUST be configured to apply its status effect in a one hundred (100) meter radius (its maximum radius), and to apply that effect starting at y-level zero (0) and up to y-level two hundred fifty-six (256), as shown in Configuration 22-1.

While the Environmental Controller can prevent hostile mob spawning and disable (Enderman) teleportation, the obelisks are preferred due to their lower energy consumption.

To make the Environmental Controller energy efficient, it is recommended to infuse it to one hundred percent (100%).



Configuration 22-1. Configuration of the Environmental Controller.

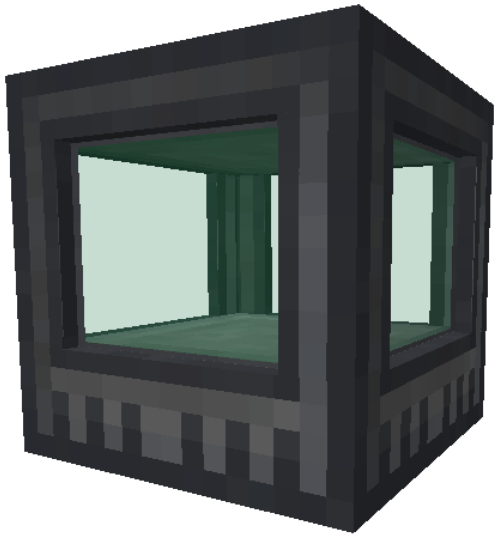


Figure 22-4. An Environmental Controller

22.2.2. Passive-Environmental Defense Systems

There is one type of Passive-EDS, Twilight Forest area/biome protection. All other biomes/devices/dimensions/methods/mods which provide similar functionality (such as FTB-Utilities-Chunks, or Applied Energistics 2's Storage Cell pocket dimension) are not in the scope of this document. The purposes of documenting the Twilight Forest's area/biome protection system is: (1) to provide an alternate approach to the more common methods of area protection (such as FTB-Utilities-Chunks, Storage Cell pocket dimensions, and the various grief protection plugins provided by servers), and (2) to promote the use of the Final Castle (a boss dungeon).

22.2.2.1. Twilight Forest Area/Biome Protection

The Twilight Forest uses a linear progression system to have the player fight specific bosses in a set order. To enforce this progression system, attempting to visit areas/biomes that have not been unlocked is prevented by: barriers, negative status effects, or both. Within protected areas (i.e., boss dungeons): blocks are unbreakable, chests are locked (with possibly all object interaction being blocked), and hostile entities will not take damage. Within protected biomes, a negative status effect is applied to the player. Protected areas within protected biomes will have all their previously mentioned effects, on top of the negative status effect applied by the biome.[6]

22.2.2.1.1. Area Protection System Affects on Machinery

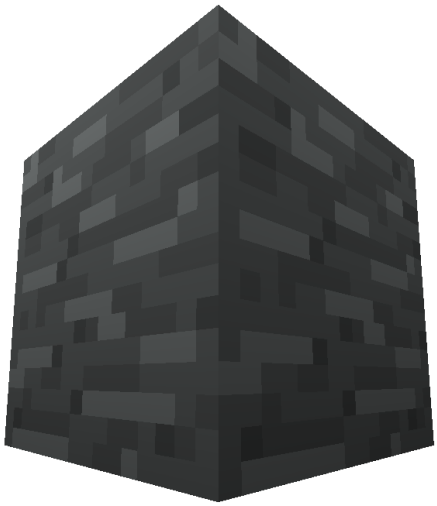
Within the volume (V) of a protected area, certain machines which modify the physical environment will be prevented from doing so by the area protection system. The area protection system will do this regardless of if the machine is owned and/or placed by an individual who has that area unlocked. From testing, affected machines are those who are able to break blocks (although not all machines which break blocks are affected).

Known affected machines and configurations:

- Builder(all Quarry Shape Cards) - RFTools
- Builder(Clearing Pump Shape Card) - RFTools
- Builder(Mode: Back) (Space Chamber Card) - RFTools
- Builder(Mode: Move) (Space Chamber Card) - RFTools
- Builder(Mode: Swap) (Space Chamber Card) - RFTools
- Builder(Pump Shape Card) - RFTools
- Builder(Void Shape Card) - RFTools
- Mechanical Miner - Extra Utilities 2

22.2.2.1.2. The Final Plateau Biome

The top surface of the Final Plateau biome resembles that of the Plains biome. The Final Plateau biome is surrounded by the Thornlands biome which is difficult to travel through without the ability to fly/glide or without the Lamp of Cinders (an item from the Twilight Forest specifically for removing the Thorns in the Thornlands). The Final Plateau biome is significantly higher than that of the surrounding Thornlands biome by approximately 36 meters (measured from the ground level of the Thornlands biome, just before the Final Plateau biome starts its sharp incline). Besides the Final Castle, the Final Plateau biome consists of one (1) type of block, Deadrock, which comes in three (3) variants: Deadrock, Cracked Deadrock, and Weathered Deadrock. All variants of Deadrock have: a blast resistance value of six million (6,000,000), and a hardness value of one hundred (100) (twice than that of Obsidian).[7][8][9]



Photograph 22-1. A block of Deadrock.

22.2.2.1.2.1. Acid Rain

If an individual does not have the 'So Castle Very Wow [NYI]' achievement, then Acid Rain will be present within the volume (V) of: the Final Plateau biome, the Thornlands biome, and the Final Castle. Acid Rain cannot be obstructed through normal means (i.e., obstructing line-of-sight to the sky). Acid Rain bypasses armor, it is possible that Acid Rain deals void damage, though this has yet to be proven. When an individual is able to perceive and be affected by Acid Rain, that also means the area protections around the Final Castle are also present for this individual.

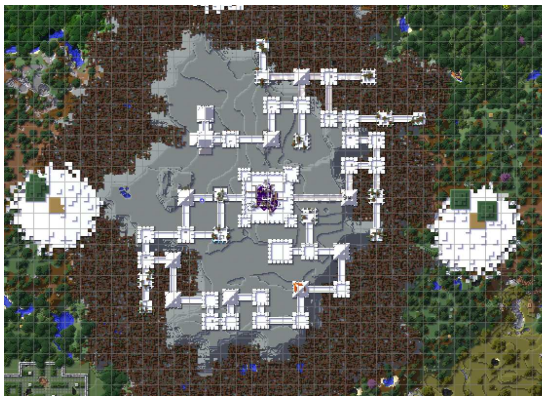
22.2.2.1.2.2. The Final Castle

The Final Castle is located on top of the Final Plateau biome. The Final Castle is comprised of the following thirty (30) blocks: Castle Brick, Worn Castle Brick, Cracked Castle Brick, Castle Roof Tile, Mossy Castle Brick, Thick Castle Brick, Castle Brick Stairs, Cracked Castle Brick Stairs, Worn Castle Brick Stairs, Mossy Castle Brick Stairs, Encased Castle Brick Pillar, Encased Castle Brick Tile, Bold Castle Brick Pillar, Bold Castle Brick Tiles, Encased Castle Brick Stairs, Bold Castle Brick Stairs, Pink Castle Rune Brick, Blue Castle Rune Brick, Yellow Castle Rune Brick, Violet Castle Rune Brick, Yellow Castle Door, Violet Castle Door, Pink Castle Door, Blue Castle Door, Violet Force Field, Pink Force Field, Orange Force Field, Green Force Field, Blue Force Field, and Chiseled Quartz Block.

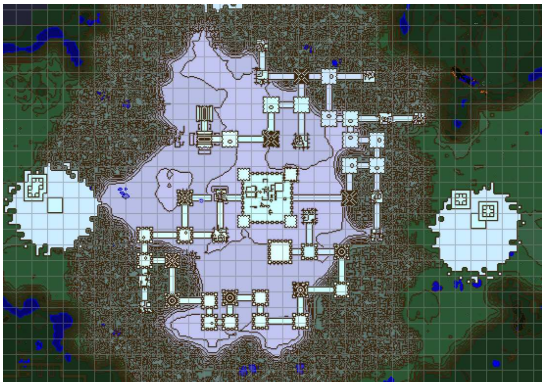
All variants of Castle Bricks have a hardness value of 100, however not all have the same blast resistance value. Those being the various types of Rune Brick (pink, blue, yellow, and violet), which can be destroyed using TNT; opposed to the other variants of Castle Brick which can not be destroyed by TNT. However, the blast resistance values for the different variants of Castle Brick is currently unknown. Additionally, all variants of the Force Field are unbreakable.

To take full advantage of the Twilight Forest's area/biome protection system, you SHOULD gain access to the Final Castle. The Final Castle is a massive structure consisting of: a Central Keep, multiple towers, two basement levels, an empty chamber below the 2nd level basement, and a final boss area (on top of the central keep). The Final Castle is not fully complete in the version of the Twilight Forest included with Direwolf20 1.12 v2.8.0. As such, much of the Final Castle is empty.

Additionally, within the Final Castle the only mobs that spawn are: Adherents, Harbinger Cubes, Armored Giants, Enderman, and Kobolds. Except for the empty chamber where only Bats and Blazes spawn. Adherents, Harbinger Cubes, Enderman, and Kolbolds are present throughout the Final Castle, with the addition of Armored Giants in the Central Keep.



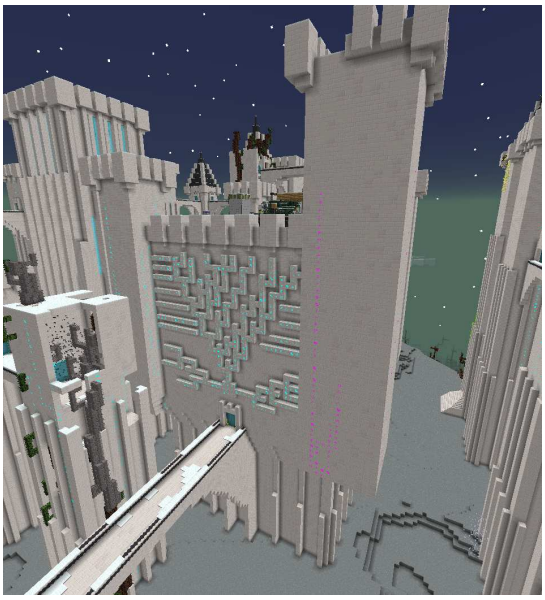
Photograph 22-2-1. The Final Castle and surrounding area, as seen by JourneyMap.



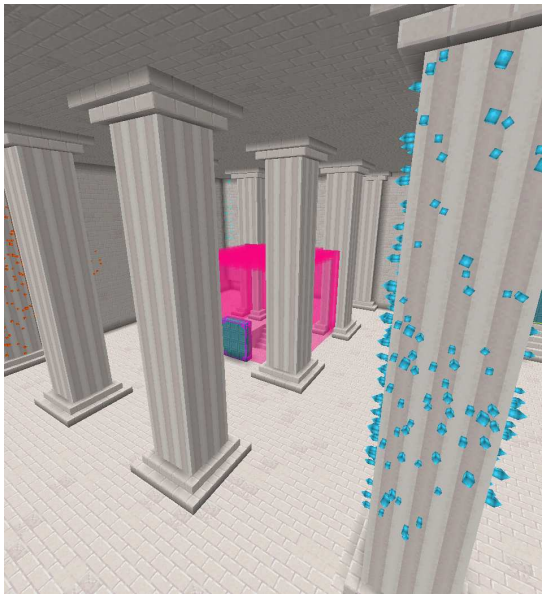
Photograph 22-2-2. Topographic map of the Final Castle and surrounding area, as seen by JourneyMap.

22.2.2.1.2.2.1. Central Keep

The Central Keep is the largest structure apart of the Final Castle, as shown in Photograph 22-3-1. It consists of two floors as shown in Photograph 22-3-2, and Photograph 22-3-3. The basement can be accessed on the first floor (in the middle of the room; through the pink shield), while the second floor can be accessed by three of four towers, the entrances for which are located on each corner of the first floor. The final boss area can also be accessed using the same towers.

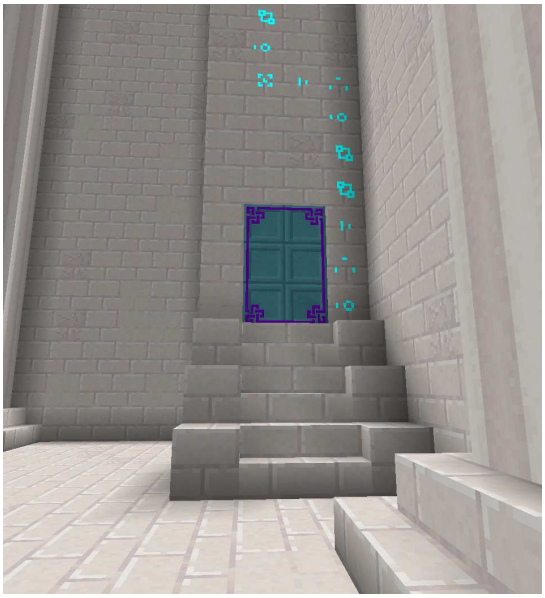


Photograph 22-3-1. The exterior of the central keep.

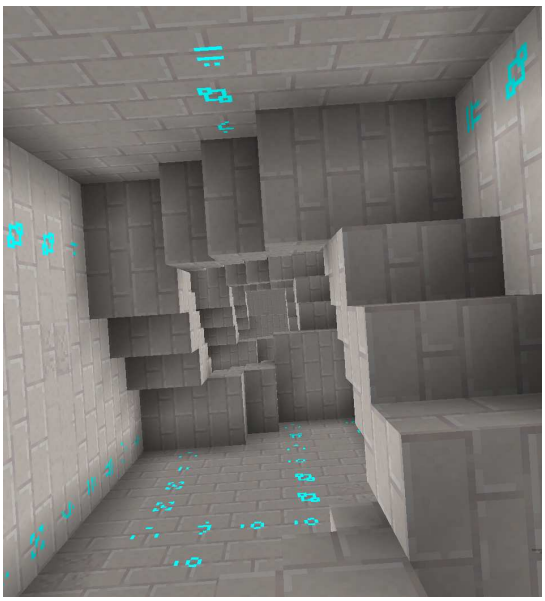


Photograph 22-3-2. The first floor of the central keep.

Photograph 22-3-3. The second floor of the central keep.



Photograph 22-3-4. One of three entrances to the towers which leading to the second floor and final boss area.

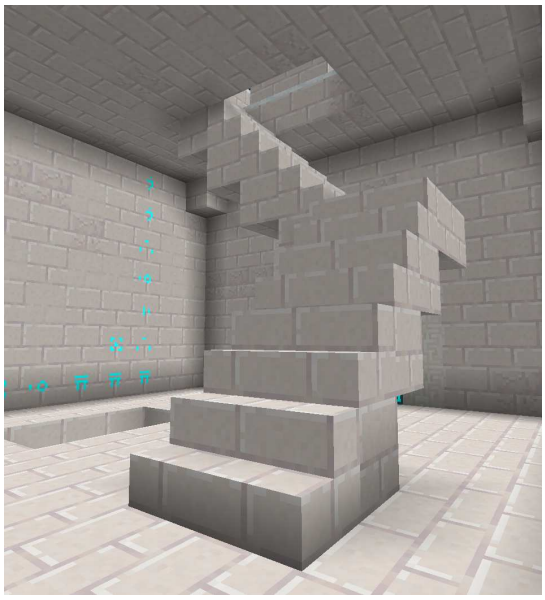


Photograph 22-3-5. Interior of one of the Central Keep's towers.

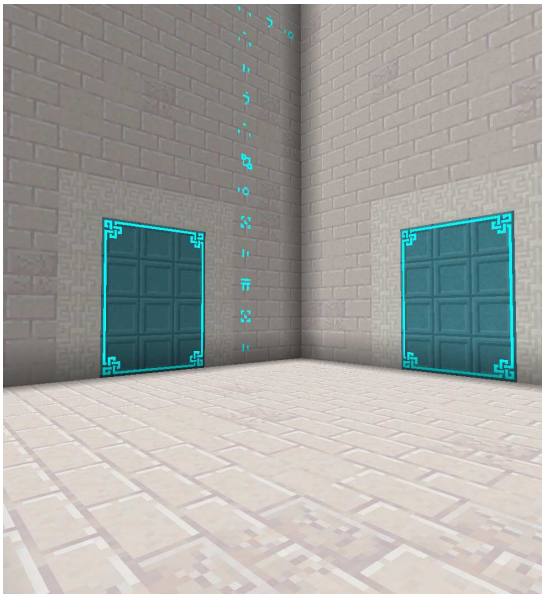
22.2.2.1.2.2.2. Towers

There are a few dozen towers which make up the rest of the above ground structure. Towers can come in two variants: normal, and decrepit. Where decrepit towers have thorn vines growing through them. Towers are connected to one another by bridges.

Photograph 22-4-1. Various towers around the central keep.



Photograph 22-4-2. Interior of a tower featuring a staircase.

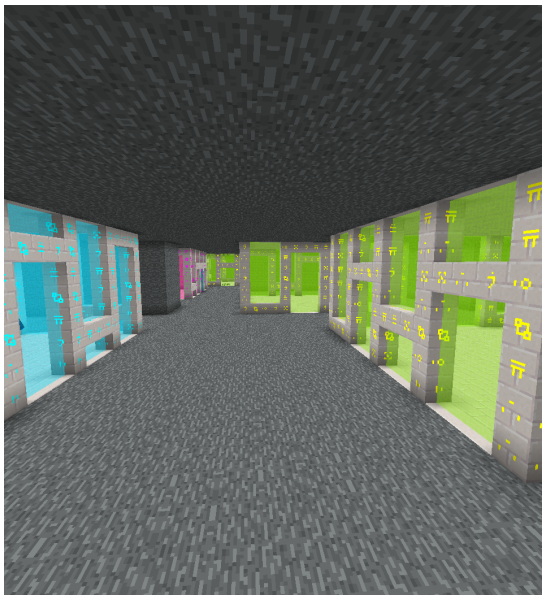


Photograph 22-4-3. Interior of a tower not featuring a staircase.

22.2.2.1.2.2.3. Basements

As stated earlier, there are two levels of basements. The floor of the first basement level sits sixty seven (67) meters below the first floor of the Central Keep. While the floor of the second basement level sits twenty two (22) meters below the first basement level. The walls, floor, and ceiling of both basements are comprised of Deadrock. There are a number of rooms within each basement. The walls of these rooms are comprised of various colors of: Castle Rune Bricks, and Force Fields; the floor and ceiling are comprised of Castle Bricks. Apart from the pink rooms, all other rooms are empty and inaccessible (lacking a door).

Photograph 22-5-1. Basement entrance on the first floor of the Central Keep.

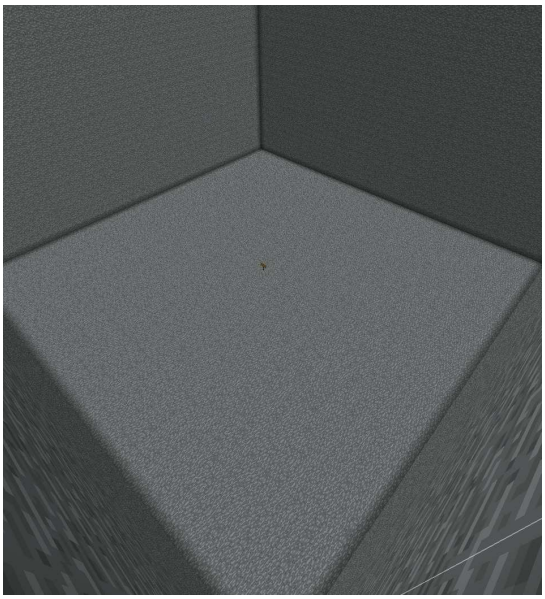


Photograph 22-5-2. Basement below the Central Keep.

Photograph 22-5-3. Pink rooms contain a staircase leading up or down.

22.2.2.1.2.2.4. The Empty Chamber

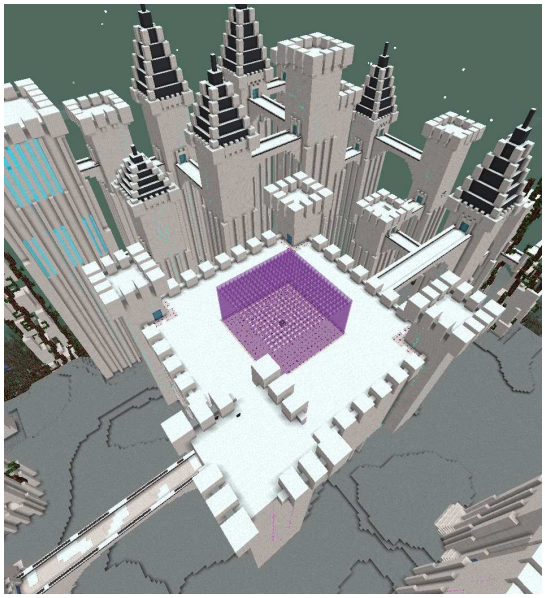
The empty chamber is an area below the second basement level who's interior dimensions measure 51 meters x 51 meters x 31 meters (Length X Width X Height). The walls, floor, and ceiling are comprised of Deadrock. Only Bats and Blazes spawn within this chamber. The sign in the middle reads 'Mini-boss 2 Gives talisman'.



Photograph 22-6. Interior of the empty chamber.

22.2.2.1.2.2.5. The Final Boss Area

The final boss area is located on top of the Central Keep. The real final boss has not been implemented yet, so a Kobold with five hundred twelve (512) hearts is spawned instead.



Photograph 22-7. The final boss area.

23. Glossary

Handoff Zone A network between the production network and the transport network where the P2P Tunnels are located. This network is filtered, meaning only certain materials are visible to it. The purpose of this network is to isolate production networks from each other when sharing/receiving materials.

Product Items/Fluid produced by a production network that is provided to one or more production networks.

Production Network An Applied Energistics 2 network which is used in each stage of production.

Resource Items/Fluid provided by a production network to be used by the current stage of production.

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