

Starcraft Environment Manual

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Contents

1	Environment	5
1.1	Installation	5
1.2	Chaoslauncher	5
1.3	The Mas2g	6
1.3.1	Map	6
1.3.2	Own Race	6
1.3.3	StarCraft Location	6
1.3.4	Debug	7
1.3.5	Auto Menu	7
1.3.6	Enemy Race	7
1.3.7	Game Speed	8
1.3.8	Invulnerable	8
1.3.9	Entity Types	8
1.4	The Development Tool	10
1.4.1	Game Speed	10
1.4.2	Cheat Actions	10
1.4.3	Map Drawing	11
2	Percepts	12
2.1	Percepts for All Units and Buildings	13
2.1.1	Available Resources	13
2.1.2	Unit Information	14
2.1.3	Player Percepts	16
2.1.4	Map Percepts	17
2.1.5	Unit Percepts	22
2.2	Building Percepts	25
2.2.1	Research and Upgrade Percepts	25
2.2.2	Production Buildings	26
2.2.3	Loadable Buildings	27

2.3	Worker percepts	28
2.3.1	Worker Management	28
2.3.2	Builder Percepts	28
2.4	Conditions	30
2.4.1	Worker Units	30
2.4.2	Buildings	30
2.4.3	All	31
2.4.4	Zerg	31
2.4.5	Terran	31
2.4.6	Protoss	32
3	Actions	33
3.1	Attack action	33
3.2	Move action	33
3.3	Attack move action	34
3.4	Upgrade action	34
3.5	Build action	34
3.6	Gather action	35
3.7	Train action	35
3.8	Stop action	35
3.9	Ability action	35
3.10	Ability on target action	36
3.11	Ability on location action	36
3.12	Research action	36
3.13	Set rally point action	37
3.14	Set rally point to unit action	37
3.15	Lift action	37
3.16	Land action	38
3.17	Build addon action	38
3.18	Load action	38
3.19	Unload action	39
3.20	Unload all action	39
3.21	Cancel action	39
3.22	Patrol action	40
3.23	Morph action (Zerg only)	40
3.24	Follow action	40
3.25	Repair action (Terran only)	41
3.26	Forfeit action	41
4	Tech Types	42

4.1	Terran Units	42
4.1.1	Battle Cruisers	42
4.1.2	Command Centers	42
4.1.3	Ghosts	42
4.1.4	Marines and Firebats	42
4.1.5	Medics	42
4.1.6	Science Vessels	43
4.1.7	Siege Tanks	43
4.1.8	Vultures	43
4.1.9	Wraith	43
4.2	Protoss Units	43
4.2.1	Arbiters	43
4.2.2	Corsairs	43
4.2.3	Dark Archons	43
4.2.4	Dark Templars	43
4.2.5	High Templars	44
4.3	Zerg Units	44
4.3.1	Generic	44
4.3.2	Defilers	44
4.3.3	Hydralisks	44
4.3.4	Lurkers	44
4.3.5	Queens	44
5	Upgrade Types	45
5.1	Terran Units	45
5.1.1	Academy	45
5.1.2	Armory	45
5.1.3	Covert Ops	45
5.1.4	Engineering Bay	45
5.1.5	Machine Shop	46
5.1.6	Physics Lab	46
5.1.7	Science Facility	46
5.1.8	Control Tower	46
5.2	Protoss Units	46
5.2.1	Arbiter Tribunal	46
5.2.2	Citadel of Adun	46
5.2.3	Cybernetics Core	46
5.2.4	Fleet Beacon	46
5.2.5	Forge	47
5.2.6	Observatory	47

5.2.7	Robotics Support Bay	47
5.2.8	Templar Archives	47
5.3	Zerg Units	47
5.3.1	Defiler Mound	47
5.3.2	Evolution Chamber	47
5.3.3	Hydralisk Den	47
5.3.4	Lair and Hive	48
5.3.5	Queen's Nest	48
5.3.6	Spawning Pool	48
5.3.7	(Greater) Spire	48
5.3.8	Ultralisk Cavern	48
6	Unit Types	49
6.1	Terran Units	49
6.1.1	Terran Ground Units	49
6.1.2	Terran Air Units	49
6.1.3	Terran Building Units	50
6.1.4	Terran Addons	50
6.2	Protoss Units	50
6.2.1	Protoss Ground Units	50
6.2.2	Protoss Air Units	51
6.2.3	Protoss Building Units	51
6.3	Zerg Units	51
6.3.1	Zerg Ground Units	51
6.3.2	Zerg Air Units	52
6.3.3	Zerg Building Units	52

Chapter 1

Environment

This section will explain how to set up and start a bot with the StarCraft environment using the GOAL programming language.

1.1 Installation

For full installation instructions, see: <https://github.com/eishub/StarCraft/wiki/Install-Guide>

1.2 Chaoslauncher

In order to make use of all the StarCraft Brood War plugins, you can make use of the Chaoslauncher application. With this application, several plugins can be used like the *BWAPI Injector* which is necessary for using the BWAPI library. It is also recommended to make use of the *APMAlert* plugin, which shows the current actions per minute of all your units together. When the APM of your bot is suddenly very high, your agents might be executing too many actions in a row. It is also recommended to make use of the *W-Mode* plugin. This plugin automatically starts your StarCraft game in windowed mode which is easier for debugging. You can also make use of the *ChaosPlugin* to make use of its autoreplay function which automatically saves a replay at the end of each game. You can play these replays by first turning off the *BWAPI Injector*. You can then start StarCraft (in the launcher) and select *Single Player* with gametype *Expansion*. Press the ‘Ok’ button and then the ‘Load Replay’ button. If you then open the **Autoreplay** directory in that screen you should be able to see all the replays which are saved by the autoreplay function.

1.3 The Mas2g

The StarCraft environment offers multiple parameters to be set up in the mas2g. Within the mas2g you can specify which map you want to play, specify your own race, set the location of your StarCraft game, turn the development tool on or off, enable the automenu script, and specify which race you want to play against. When any of these parameters are updated, do not forget to close the Chaoslauncher before launching the mas2g, or else your changes will not be applied.

```
use "../../StarCraft Connector.jar" as environment with
  map="(2)Destination.scx",
  own_race="terran",
  StarCraft_location="C:\\StarCraft",
  debug="true",
  auto_menu="Single_Player",
  enemy_race="zerg",
  game_speed=50.
```

1.3.1 Map

It is possible to specify which map the Chaoslauncher will automatically load when starting the game. This can be done by inserting the following line: *map = <filename>*, where *<filename>* is the exact filename of the map (with extension). Please note that the environment only supports maps in the directory: *StarCraft/maps/sscai*. Please note that the first time running the environment on a certain map will take some time (around 2 minutes) to generate the API data of the given map.

1.3.2 Own Race

You may also specify the race of your bot in the mas2g. This will automatically launch the Chaoslauncher with the specified race. You can do this by inserting the following line: *own_race = <RaceName>*, where *<RaceName>* can either be *zerg*, *protoss*, *terran* or *random*. The option *random* will choose one race with a 1/3 chance for each race.

1.3.3 StarCraft Location

It is also possible to specify the location of the StarCraft game. When using the StarCraft game provided by the environment installer, this feature will

automatically start the Chaoslauncher when launching the GOAL MAS. When the Chaoslauncher is already running, it will not start again until you close it, but this is fine as long as you use the same init parameters. When the Chaoslauncher is automatically started by the environment, an automatic script will be written with all the necessary information to run the GOAL agents (so it is recommended to use this feature). You can use this feature by inserting the line: *StarCraft_location* = *<FilePath>*, where *<FilePath>* is the absolute path to the StarCraft installation folder.

1.3.4 Debug

The environment also offers a development tool for debugging purposes. With this development tool, you can increase or decrease the game speed, enable cheats and draw unit and map details on the screen. More information about the development tool can be found at 1.4. In order to enable or disable launching the development tool, you can insert the following line: *debug*=*<Boolean>*.

1.3.5 Auto Menu

The auto menu parameter can be used to automatically go through the menus of the game when starting your agents. This can be used for single player games and multi player games. To use the auto menu function you can insert the following line: *auto_menu*=*<MenuChoice>*, where *<MenuChoice>* can take the following values:

Single_Player: for a single player game.

Multi_Player: for a multiplayer game.

LAN: for a local multiplayer game.

1.3.6 Enemy Race

The enemy race parameter can be used for specifying which race you want to play against. When an actual enemy race is chosen like: *zerg*, *protoss* or *terran*, the *enemyRace* percept will indicate against which race you are playing. If you do not specify an enemy race, which is equal to the *random* option, the *enemyRace* percept will be *unknown* until the opponent is scouted for the first time. To use the enemy race parameter you can insert the following line: *enemy_race*=*<RaceName>*, where *<RaceName>* can either be *zerg*, *protoss*, *terran* or *random*. The option *random* will choose one race with a 1/3 chance for each race.

1.3.7 Game Speed

The game speed parameter can be used to set the initial speed of the game when the StarCraft game is launched. StarCraft makes use of a logical frame rate, which means that the `game_speed` depends on the amount of frames per second (fps) used to update the game. So the higher the fps, the faster the game will go. For using the `game_speed` parameter you can insert the following line: `game_speed=<FPS>`, where `<FPS>` is a positive integer. If the integer 0 is used, there will be no limit on the amount of FPS used and the game will thus run as fast as it possibly can. **Please note that when integer 0 is used the gameSpeed/1 percept will not give accurate results.** The default (tournament-speed) FPS is 50.

1.3.8 Invulnerable

The invulnerable parameter can be used to make your units invulnerable from the start of the game. This can come in handy for testing purposes when you don't want to fight your opponent. To use the invulnerable function you can insert the following line: `invulnerable=<Boolean>`.

1.3.9 Entity Types

When defining a launch rule it is important that a correct entity type is used. This value has to be the same type of the StarCraft unit without spaces and where the first letter is uncapitalised. So when you for example want to connect an agent to a **terran SCV**, this can be done by using the entity type `terranSCV`. Note that each unit type starts with the race of the unit, followed by the exact name of the unit type.

```
define myAgent as agent {
    use MyAgentInit as init module.
    use MyAgent as main module.
    use MyAgentEvent as event module.
}

launchpolicy {
    when type = terranSCV launch myAgent.
}
```

When using mind control while being protoss, some units from other races can be taken over. These units will also get an entity. An easy way to accomodate all these entities is:

```
while type=* launch ...
```

1.4 The Development Tool

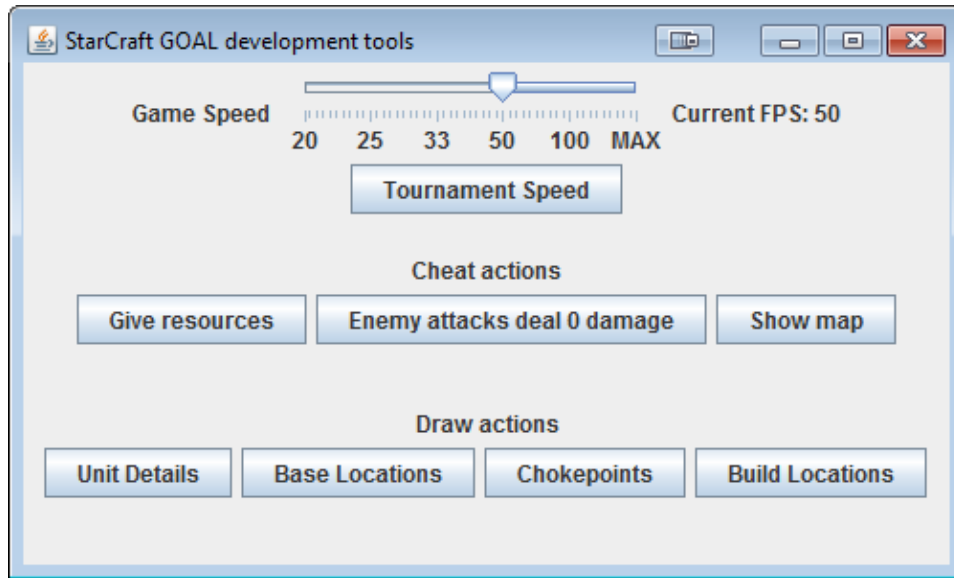


Figure 1.1: Example of the Development Tool

1.4.1 Game Speed

The Game Speed slider can be found at the top of the development tool window. This can be used to quickly change the speed of the game. The initial game speed is set to 50 fps (logical frames). The slowest speed is 20 fps and from there you can set it as fast as you want. Please note that the agent is supposed to play normally at 50 fps which is the default game speed for AI tournaments. When the speed is set to a 100 fps or higher, the agents can react slower than they would on the tournament gamespeed. Setting the game speed on 100 or higher should only be used for quick testing purposes.

1.4.2 Cheat Actions

The development tool offers 3 buttons which instantly enable StarCraft cheats. Note that these cheats should be used for testing purposes only. The first cheat is called: *Give resources* which gives the player 10000 minerals and 10000 gas. The second cheat is called: *Enemy attacks deal 0 damage*

which makes the units of the player immune for damage. The last cheat is called: *Show map* which makes the whole map visible for the player. Note that all your agents will then also perceive everything on the map.

1.4.3 Map Drawing

The development tool can also be used to show map or unit details. There are 4 buttons which can be used. First there is the *Unit Details* button which shows the health and *ID* of every unit. There is also the *Base Locations* button which shows all the starting locations of the map and also all the base locations on the map where players could be expanding to. There is also the *Chokepoints* button which shows all the chokepoints (which are the narrow points where not many units can go through at the same time) on the map. Finally there is the *Build Locations* button which shows all the non-obstructed and explored building locations of the map which the worker units perceive with the *constructionSite* percept.

Chapter 2

Percepts

This section will list all the percepts that are usable in the StarCraft environment. The percepts vary per unit, for example: an attacking unit will not perceive the amount of resources available to the player as he does not need them. For the implementation of these percepts in your GOAL code, please refer to the GOAL programming guide.

2.1 Percepts for All Units and Buildings

2.1.1 Available Resources

Resources percept

Description The amount of minerals, gas and supply available to the player (i.e. shared by all units). NOTE: supply is multiplied by 2 throughout this interface, so 10 supply in game corresponds with 20 supply in this environment.

Type Send on change

Syntax `resources(<M>, <G>, <CS>, <TS>)`

Example `resources(350, 100, 25, 41)`

Parameters	<M>	The current amount of minerals available to the player.
	Type	Positive Integer
	Range	[0–∞]
	<G>	The current amount of gas available to the player.
	Type	Positive Integer
	Range	[0–∞]
	<CS>	The supply of the player which is currently in use.
	Type	Positive Integer
	Range	[0–400]
	<TS>	The total amount of supply the player can currently use. Note that <TS> is always greater or equal to <CS>
	Type	Positive Integer
	Range	[0–400]

2.1.2 Unit Information

Self percept

Description	The (unique) <i>ID</i> and type of the unit. Also gives information about the maximum health, shield and energy of the unit.
Type	Send once
Syntax	<code>self(<ID>, <UnitType>, <MaxHealth>, <MaxShield>, <MaxEnergy>)</code>
Example	<code>self(21, Terran SCV, 60, 0, 0)</code>

Parameters	<ID> Type Range	The (unique) <i>ID</i> of the unit. Positive Integer [0–∞]
	<UnitType> Type	The type of the unit. The type of a unit consists of a string with the race of the unit and the name of the unit parted by a space. See Section 6 for the list of all the unit types. String
	<MaxHealth> Type Range	The maximum amount of health of the unit. Positive Integer [0–2500]
	<MaxShield> Type Range	The maximum amount of shield of the unit. Positive Integer [0–2500]
	<MaxEnergy> Type Range	The maximum amount of energy of the unit. Positive Integer [0–2500]

Defensive Matrix percept

Description	Information about how much health the defensive matrix has left on the unit. Note: this only applies to specific Terran units.
Type	Send on change
Syntax	<code>defensiveMatrix(<health>)</code>
Example	<code>defensiveMatrix(200)</code>

Parameters	<health>	The amount of health left of the defensive matrix.
	Type Range	Positive Integer [0–250]

Status percept

Description The current amount of health, shield and energy of the unit.
The **status** percept also shows the conditions of the unit and its current position.

Type Send on change

Syntax **status**(<Health>, <Shield>, <Energy>, <Cond>, <X>, <Y>)

Example **status**(250, 0, 0, [moving, carrying], 24, 36)

Parameters	<Health> Type Range	The current amount of health of the unit. Positive Integer [0–<MaxHealth>] where <MaxHealth> is the maximum health of the given unit.
	<Shield> Type Range	The current amount of shields of the unit. Positive Integer [0–<MaxShield>] where <MaxShield> is the maximum shield of the given unit.
	<Energy> Type Range	The current amount of energy of the unit. Positive Integer [0–<MaxEnergy>] where <MaxEnergy> is the maximum energy of the given unit.
	<Cond> Type	The current condition of the unit. Each unit can have multiple or no conditions depending on the unit and situation. See Section 2.4 for the list of all the conditions. List of Strings
	<X> Type Range	The x-coordinate of the unit in the map. Positive Integer [0–∞]
	<Y> Type Range	The y-coordinate of the unit in the map. Positive Integer [0–∞]

New Unit percept

Description Indicates when a new unit is under construction.

Type Send on change

Syntax **newUnit**(<ID>, <X>, <Y>)

Example **newUnit**(44, 22, 37)

Parameters	<ID>	The (unique) <i>ID</i> of the unit.
	Type	Positive Integer
	Range	[0-∞]
	<X>	The x-coordinate of the unit in the map.
	Type	Positive Integer
	Range	[0-∞]
	<Y>	The y-coordinate of the unit in the map.
	Type	Positive Integer
	Range	[0-∞]

2.1.3 Player Percepts

Enemy Race percept

Description The race of your opponent.
 Type Send once
 Syntax `enemyRace(<Race>)`
 Example `enemyRace(protooss)`
 Example When playing against a random race.

```
if bel(enemyRace(unknown), enemy(Type,_,_,_,_),
sub_string(Type, 0,1,_,Race)) then {
  if bel(Race = "Z") then delete(enemyRace(unknown))
  + insert(enemyRace(zerg)).
  if bel(Race = "P") then delete(enemyRace(unknown))
  + insert(enemyRace(protooss)).
  if bel(Race = "T") then delete(enemyRace(unknown))
  + insert(enemyRace(terran)).
}
```

Parameters	<Race>	The enemy race which can take the value: protooss, terran, zerg or unknown when the enemy race is random.
	Type	String

Game Speed percept

Description The current game speed in frames per seconds. For more information see Section 1.3.7.
 Type Send on change
 Syntax `gameSpeed(<FPS>)`
 Example `gameSpeed(50)`

Parameters	<FPS>	The current amount of frames per second the game is updated by.
	Type	Positive Integer
	Range	[0– ∞]

Winner percept

Description At the end of the game all units will receive this depending whether they have won or not.

Type Send always

Syntax `winner(<hasWon>)`

Example `winner(true)`

Parameters	<hasWon>	Boolean which indicates whether you have won or not.
	Type	Boolean

Nuke percept

Description Indicates that a nuclear strike will land on the given position.

Type Send on change

Syntax `nuke(<X>,<Y>)`

Example `nuke(22, 37)`

Parameters	<X>	The x-coordinate of the nuclear strike.
	Type	Positive Integer
	Range	[0– ∞]
	<Y>	The y-coordinate of the nuclear strike.
	Type	Positive Integer
	Range	[0– ∞]

2.1.4 Map Percepts**Map percept**

Description The width and the height of the map (no. of squares).

Type Send once

Syntax `map(<Width>,<Height>)`

Example `map(96, 128)`

Parameters	<Width>	The width of the map.
	Type Range	Positive Integer [0–∞]
	<Height>	The height of the map.
	Type Range	Positive Integer [0–∞]

Base percept

Description All the base locations of the map. These are possible construction sites for bases.

Type Send once

Syntax `base(<X>,<Y>,<IsStart>,<ResourceGroupID>)`

Example `base(28, 32, true, 8)`

Parameters	<X>	The x-coordinate of the base location.
	Type Range	Positive Integer [0–∞]
	<Y>	The y-coordinate of the base location.
	Type Range	Positive Integer [0–∞]
	<IsStart>	Indicates whether the location is a starting location or not.
	Type	Boolean (true or false)
	<ResourceGroupID>	The Resource Group that is closest to this base location. The vespene geyser and all mineral fields will share this Resource group.
	Type Range	Positive Integer [0–∞]

Chokepoint/3 percept

Description All the chokepoints on the map. These are the narrow points on the map where only a limited amount of units can go through at the same time.

Type Send once

Syntax `chokepoint(<X>,<Y>,<W>)`

Example `chokepoint(12, 15, 50)`

Parameters	<X>	The x-coordinate of the chokepoint.
	Type	Positive Integer
	Range	[0–∞]
	<Y>	The y-coordinate of the chokepoint.
	Type	Positive Integer
	Range	[0–∞]
	<W>	The size of the chokepoint (in pixels).
	Type	Positive Integer
	Range	[0–∞]

Chokepoint/4 percept

Description All the chokepoints on the map. These are the narrow points on the map where only a limited amount of units can go through at the same time.

Type Send once

Syntax `chokepoint(<X1>,<Y1>,<X2>,<Y2>)`

Example `chokepoint(12, 15, 14, 17)`

Parameters	<X1>	The x-coordinate of the first side of the chokepoint.
	Type	Positive Integer
	Range	[0–∞]
	<Y1>	The y-coordinate of the first side of the chokepoint.
	Type	Positive Integer
	Range	[0–∞]
	<X2>	The x-coordinate of the second side of the chokepoint.
	Type	Positive Integer
	Range	[0–∞]
	<Y2>	The y-coordinate of the second side of the chokepoint.
	Type	Positive Integer
	Range	[0–∞]

Chokepoint/6 percept

Description	All the chokepoints on the map. These are the narrow points on the map where only a limited amount of units can go through at the same time. This percept also sends the regions that this chokepoint connects.
Type	Send once
Syntax	<code>chokepoint(<X1>,<Y1>,<X2>,<Y2>,<RegionID1>,<RegionID2>)</code>
Example	<code>chokepoint(12, 15, 14, 17, 1, 2)</code>

Parameters	<X1> Type Range	The x-coordinate of the first side of the choke-point. Positive Integer [0-∞]
	<Y1> Type Range	The y-coordinate of the first side of the choke-point. Positive Integer [0-∞]
	<X2> Type Range	The x-coordinate of the second side of the choke-point. Positive Integer [0-∞]
	<Y2> Type Range	The y-coordinate of the second side of the choke-point. Positive Integer [0-∞]
	<RegionID1> Type Range	The ID of the first region. Positive Integer [0-∞]
	<RegionID2> Type Range	The ID of the second region. Positive Integer [0-∞]

Region/5 percept

Description	All the regions on the map. Regions are connected by choke-points and can be on high or low ground.
Type	Send once
Syntax	<code>region(<Id>,<CenterX>,<CenterY>,<Height>,<ConnectedRegionsList>)</code>
Example	<code>region(12, 15, 14, 17, [1,2])</code>

Parameters	<Id> Type Range	The ID of the region. Positive Integer $[0-\infty]$
	<CenterX> Type Range	The x-coordinate of the center of the region. Positive Integer $[0-\infty]$
	<CenterY> Type Range	The y-coordinate of the center of the region. Positive Integer $[0-\infty]$
	<Height> Type Range	The height of the region. Positive Integer $[0-\infty]$
	<ConnectedRegionsList> Type	A list of regions that are connected to this region. List

Region/2 percept

Description Gives information about which region on the map a unit is in.

Type Send on change

Syntax `region(<UnitID>, <RegionID>)`

Example `region(12, 15)`

Parameters	<UnitID> Type Range	The Id of a unit in a region. Sent for every visible unit. Positive Integer $[0-\infty]$
	<RegionID> Type Range	The ID of the region. Positive Integer $[0-\infty]$

2.1.5 Unit Percepts**Friendly percept**

Description Information about all (alive) units of the player.

Type Send always

Syntax `friendly(<Type>, <ID>, <Condition>)`

Example `friendly(Protoss Gateway, 26, [beingConstructed])`

Parameters	<Type>	The type of the unit. The type of a unit consists of a string with the race of the unit and the name of the unit parted by a space. See Section 6 for the list of all the unit types.
	Type	String
	<ID> Type Range	The (unique) <i>ID</i> of the unit. Positive Integer [0–∞]
	<Cond>	The current condition of the unit. Each unit can have multiple or no conditions depending on the unit and situation. See Section 2.4 for the list of all actual conditions.
	Type	List of Strings

Enemy percept

Description Information about all (alive) enemy units that are currently visible to the player.

Type Send always

Syntax `enemy(<Type>,<ID>,<Health>,<Shield>,<Condition>,<X>,<Y>)`

Example `enemy(Zerg Overlord, 12, 200, 0, [flying], 120, 96)`

Note Enemy units that are cloaked are also perceived, but cannot be attacked.

Parameters	<Type>	The type of the unit. The type of a unit consists of a string with the race of the unit and the name of the unit parted by a space.
	Type	String
	<ID>	The (unique) <i>ID</i> of the unit.
	Type	Positive Integer
	Range	$[0-\infty]$
	<Health>	The current amount of health of the unit.
	Type	Positive Integer
	Range	$[1-\text{<maxHealth>}]$ where <maxHealth> is the maximum health of the given unit.
	<Shield>	The current amount of shields of the unit.
	Type	Positive Integer
	Range	$[0-\text{<maxShield>}]$ where <maxShield> is the maximum shield of the given unit.
	<Cond>	The current condition of the unit. Each unit can have multiple or no conditions depending on the unit and situation. Not all the conditions are available for the enemy percept. See Section 2.4 for the list of all actual conditions.
	Type	List of Strings
	<X>	The x-coordinate of the unit.
	Type	Positive Integer
	Range	$[0-\infty]$
	<Y>	The y-coordinate of the unit.
	Type	Positive Integer
	Range	$[0-\infty]$

Attacking percept

Description Shows the enemy units which are attacking and which units they have targeted.

Type Send always

Syntax `attacking(<ID>,<TargetID>)`

Example `attacking(123, 177)`

Parameters	<ID>	The (unique) <i>ID</i> of the enemy unit which is attacking.
	Type Range	Positive Integer [0–∞]
	<TargetID>	The (unique) ID of the targeted unit which is being attacked.
	Type Range	Positive Integer [0–∞]

2.2 Building Percepts**2.2.1 Research and Upgrade Percepts****Researching percept**

Description Indicates which *tech* is currently being researched. The research is done when this percept is no longer seen. See Section 4 for the list of tech types.

Type Send always

Syntax `researching(<TechType>)`

Example `researching(Stim Packs)`

Parameters	<TechType>	The <i>tech</i> which is currently researched.
	Type	String

Upgrading percept

Description Indicates which *upgrade* is currently being performed. The upgrade is done when this percept is no longer seen. See Section 5 for the list of all actual tech types.

Type Send always

Syntax `upgrading(<UpgradeType>)`

Example `upgrading(Ocular Implants)`

Parameters	<UpgradeType>	The <i>upgrade</i> which is currently upgraded.
	Type	String

2.2.2 Production Buildings

Queue Size percept

Description Shows how many units are in queue of the production building.
Hatchery: Shows the amount of available larva units.

Type Send on change

Syntax `queueSize(<Size>)`

Example `queueSize(2)`

Parameters	<Size>	The size of the current queue.
	Type	Positive Integer
	Range	[0–5]

Rally Point percept

Description The position of the building's rallypoint in map coordinates.

Type Send on change

Syntax `rallyPoint(<X>,<Y>)`

Example `rallyPoint(76, 45)`

Parameters	<X>	The x-coordinate of the rallypoint.
	Type	Positive Integer
	Range	[0–∞]
	<Y>	The y-coordinate of the rallypoint.
	Type	Positive Integer
	Range	[0–∞]

Rally Unit percept

Description Shows on which unit the building's rallypoint is set.

Type Send on change

Syntax `rallyUnit(<UnitID>)`

Example `rallyUnit(145)`

Parameters	<UnitID>	The (unique) <i>ID</i> the rallypoint points to.
	Type	Positive Integer
	Range	[0–∞]

2.2.3 Loadable Buildings

Space Provided percept

Description	Shows how many units are currently loaded in the building and how the maximum amount of units that can be loaded in the building.
Type	Send on change
Syntax	<code>spaceProvided(<CSize>, <MSize>)</code>
Example	<code>spaceProvided(2, 4)</code>

Parameters	<CSize>	The amount of currently loaded units.
	Type Range	Positive Integer [0–∞]
	<MSize>	The maximum amount of units that can be loaded.
	Type Range	Positive Integer [0–∞]

Unit Loaded percept

Description	Shows which unit is loaded inside the given loadable unit.
Type	Send always
Syntax	<code>unitLoaded(<ID>, <Type>)</code>
Example	<code>unitLoaded(154, Terran Marine)</code>

Parameters	<ID>	The (unique) <i>ID</i> of the loaded unit.
	Type Range	Positive Integer [0–∞]
	<Type>	The type of the loaded unit.
	Type	String

2.3 Worker percepts

2.3.1 Worker Management

Worker Activity Percept

Description Shows the current activity of the worker.

Type Send on change

Syntax `workerActivity(<Activity>)`

Example `workerActivity(gatheringGas)`

Parameters	<Activity>	The current activity of the worker unit. Can take values: gatheringGas, gatheringMinerals, constructing or idling.
	Type	String

2.3.2 Builder Percepts

Vespene Geyser percept

Description Information about a visible (possibly empty) vespene geyser on the map.

Type Send always

Syntax `vespeneGeyser(<ID>, <Resources>, <ResourceGroup>, <X>, <Y>)`

Example `vespeneGeyser(57, 5000, 6, 22, 32)`

Parameters	<ID> Type Range	The (unique) <i>ID</i> of the vespene geyser. Positive Integer [0-∞]
	<Resources> Type Range	The amount of resources left in the vespene geyser. Positive Integer [0-5000]
	<ResourceGroup> Type Range	The resource group of the vespene geyser. Positive Integer [0-∞]
	<X> Type Range	The x-coordinate of the vespene geyser. Positive Integer [0-∞]
	<Y> Type Range	The y-coordinate of the vespene geyser. Positive Integer [0-∞]

Mineral Field percept

Description Information about a visible (non-empty) mineralfield on the map.

Type Send always

Syntax `mineralField(<ID>,<Resources>,<ResourceGroup>,<X>,<Y>)`

Example `mineralField(57, 5000, 6, 22, 32)`

Parameters	<div> <div><ID></div> <div>Type</div> <div>Range</div> </div>	<div>The (unique) <i>ID</i> of the mineralfield.</div> <div>Positive Integer</div> <div>[0–∞]</div>
	<div> <div><Resources></div> <div>Type</div> <div>Range</div> </div>	<div>The amount of resources left in the mineralfield.</div> <div>Positive Integer</div> <div>[1–5000]</div>
	<div> <div><ResourceGroup></div> <div>Type</div> <div>Range</div> </div>	<div>The resource group of the mineralfield.</div> <div>Positive Integer</div> <div>[0–∞]</div>
	<div> <div><X></div> <div>Type</div> <div>Range</div> </div>	<div>The x-coordinate of the mineralfield.</div> <div>Positive Integer</div> <div>[0–∞]</div>
	<div> <div><Y></div> <div>Type</div> <div>Range</div> </div>	<div>The y-coordinate of the mineralfield.</div> <div>Positive Integer</div> <div>[0–∞]</div>

Construction Site percept

Description Shows all explored and non-obstructed construction sites where at least a Protoss Nexus, Terran Command Center or Zerg Hatchery can be placed.

Type Send always

Syntax (If Protoss) `constructionSite(<X>,<Y>,<InPylonRange>)`
 (If Zerg) `constructionSite(<X>,<Y>,<onCreep>)`
 (If Terran) `constructionSite(<X>,<Y>)`

Example `constructionSite(66, 98, false)`
`constructionSite(66, 98)`

Parameters	<X> Type Range	The x-coordinate of the construction site. Positive Integer [0-∞]
	<Y> Type Range	The y-coordinate of the construction site. Positive Integer [0-∞]
	<InPylonRange> Type Range	Indicates whether the construction site is in range of a pylon (this is only for Protoss) Boolean [True-False]
	<onCreep> Type Range	Indicates whether the construction site is on creep (this is only for Zerg) Boolean [True-False]

2.4 Conditions

2.4.1 Worker Units

carrying	Indicates when the worker unit is carrying minerals or vespene gas.
constructing	Shows that the worker unit is busy constructing a building.

2.4.2 Buildings

beingConstructed	Indicates when a building is being constructed.
lifted	Indicates when the building is lifted.
<addonName>	Indicates when an addon of the building is present, gives the exact addonname.

2.4.3 All

idle	Indicates when the unit is idle (not doing anything).
cloaked	Indicates when a unit is cloaked.
moving	Shows that a unit is moving.
following	Shows that a unit is following an other unit.
loaded	Indicates when a unit is loaded.
defenseMatrixed	Indicates when a unit has a defense matrix on it.
flying	Shows that a unit is flying.
patrolling	Shows that a unit is patrolling between 2 positions.
underAttack	Indicates when the unit is under attack.
attacking	Indicates when a unit is attacking an other unit.
detected	Indicates when a cloaked/burrowed unit has been detected.
coolingDown	Indicates when a unit cannot attack due to cooldown.
hasScarabs	Indicates if a reaver has scarabs.
acidSpored	Indicates when a unit is acidSpored.

2.4.4 Zerg

burrowed	Indicates when a zerg unit is burrowed.
ensnared	Shows that the unit is ensnared by a Queen unit.
parasited	Shows that the unit is parasited by a Queen unit.
plagued	Indicates that the unit is plagued by a Defiler unit.
darkSwarmed	Indicates that the unit is under a Dark Swarm from a Defiler unit.
morphing	Indicates that a unit is morphing.

2.4.5 Terran

stimmed	Indicates when a firebat or marine is stimmed.
sieged	Indicates when a siegetank is in siegemode.
blinded	Shows when a unit is blinded by a medic.
lockDowned	Indicates when a unit is under lockdown by a Ghost unit.
Irradiated	Shows when a unit is irradiated by a Science Vessel.
nukeReady	Indicates when a unit is ready to use Nuclear Missile.
beingHealed	Indicates when a unit is healed by an other unit.
repairing	Shows that a unit is repairing.
hasMines	Indicates whether a vulture has mines.

2.4.6 Protoss

<code>underStorm</code>	Shows when a unit is under a storm from a High Templar unit.
<code>inStasis</code>	Indicates when a unit is stuck in stasis.
<code>maelstrommed</code>	Indicates when a unit is maelstrommed by a Dark Archon.
<code>disruptionWebbed</code>	Shows when a unit is in a disruption web from a Corsair.

Chapter 3

Actions

This section will list all the actions that are usable in the Starcraft environment.

3.1 Attack action

Description	Attack the given enemy unit.
Syntax	<code>attack(<TargetID>)</code>
Parameters	<code><TargetID></code> : The <i>ID</i> of the target that will be attacked.
Pre	The targeted unit is attack capable.
Post	The targeted unit is being attacked by your unit.
Note	Medics that use this action on a friendly unit will heal them. Medics cannot attack enemies.

3.2 Move action

Description	Move to the chosen location.
Syntax	<code>move(<X>,<Y>)</code>
Parameters	<code><X></code> : The x-coordinate of the chosen location <code><Y></code> : The y-coordinate of the chosen location
Pre	The unit is capable of moving to the chosen location.
Post	The unit moves to the chosen location (ignoring any other unit it might pass by).

3.3 Attack move action

Description	Go to the given location and attack everything you encounter.
Syntax	<code>attack(<X>,<Y>)</code>
Parameters	<code><X></code> : The x-coordinate of the chosen location <code><Y></code> : The y-coordinate of the chosen location
Pre	The unit is capable of moving to the chosen location.
Post	The unit moves to the chosen locations and attacks any attack capable enemy unit it encounters.

3.4 Upgrade action

Description	Starts working on the chosen upgrade.
Syntax	<code>upgrade(<UpgradeName>)</code>
Parameters	<code><UpgradeName></code> : The name of the upgrade you want to upgrade.
Pre	The unit is capable of upgrading and has sufficient resources to do so.
Post	The unit starts upgrading the chosen upgrade.

3.5 Build action

Description	Build a building on the given location.
Syntax	<code>build(<Type>,<X>,<Y>)</code>
Parameters	<code><Type></code> : The Type of the building that has to be built. <code><X></code> : The x-coordinate of the chosen build location <code><Y></code> : The y-coordinate of the chosen build location
Pre	The unit is capable of constructing the chosen building and the chosen location is not obstructed.
Post	The unit starts constructing the chosen building at the chosen location.

3.6 Gather action

Description	Gather the chosen resource (minerals or vespene gas).
Syntax	gather (<ID>)
Parameters	<ID>: The <i>ID</i> of the chosen resource.
Pre	The unit is capable of performing the gather action and a valid resource unit is selected.
Post	The unit starts gathering the chosen resource.

3.7 Train action

Description	Train the chosen unit.
Syntax	train (<Type>)
Parameters	<Type>: The type of unit to train.
Pre	The production facility is capable of producing the chosen unit and has sufficient resources to do so.
Post	The production facility starts producing the chosen unit.

3.8 Stop action

Description	Stop performing the current action.
Syntax	stop
Pre	The unit is performing some kind of action.
Post	The unit stops performing the action.

3.9 Ability action

Description	Use an (researched) ability.
Syntax	ability (<Type>)
Parameters	<Type>: The type of technology to use.
Pre	The chosen tech type is researched and the unit is capable of performing the chosen tech type.
Post	The unit performs the chosen tech ability.
Note	In game behaviour that can be toggled on and off such as Burrow/Cloak/Siege is also executed by using this action.

3.10 Ability on target action

Description	Use an (researched) ability on a target.
Syntax	ability (<Type>, <Target>)
Parameters	<Type>: The type of technology to use. <Target>: The target to use the technology on.
Pre	The chosen tech type is researched, the unit is capable of performing the chosen tech type and the chosen target is attack capable.
Post	The unit performs the chosen tech ability on the chosen target.

3.11 Ability on location action

Description	use an (researched) ability on a location.
Syntax	ability (<Type>, <X>, <Y>)
Parameters	<Type>: The type of technology to use. <X>: The x-coordinate of the chosen location <Y>: The y-coordinate of the chosen location.
Pre	The chosen tech type is researched, the unit is capable of performing the chosen tech type and the chosen location is valid to perform an action on.
Post	The unit performs the chosen tech ability on the chosen location.

3.12 Research action

Description	Research a chosen tech type.
Syntax	research (<Type>)
Parameters	<Type>: The type of tech to research.
Pre	The building is capable of researching the chosen tech type and has sufficient resources to do so.
Post	The building starts researching the chosen tech type.

3.13 Set rally point action

Description	Set the rally point on a specific location. When the rally point is set, produced units of this production facility will automatically move to this location.
Syntax	<code>setRallyPoint(<X>, <Y>)</code>
Parameters	<code><X></code> : The x-coordinate of the chosen rally location <code><Y></code> : The y-coordinate of the chosen rally location.
Pre	The building is capable of setting up a rally point and the chosen location is a valid location where units can move to.
Post	The building sets the rally point on the chosen location.

3.14 Set rally point to unit action

Description	Set the rally point on a unit. When the rally point is set, produced units of this production facility will automatically move to this unit.
Syntax	<code>setRallyPoint(<Unit>)</code>
Parameters	<code><Unit></code> : The unit to set the rally point on.
Pre	The building is capable of setting up a rally point and the chosen unit is on a valid location where units can move to.
Post	The building sets the rally point on the chosen unit.

3.15 Lift action

Description	Lift into the air.
Syntax	<code>lift</code>
Pre	The building is capable of flying and is not busy performing any other action.
Post	The building starts flying.
Note	Only for Terran buildings.

3.16 Land action

Description	Land on the given location.
Syntax	<code>land(<X>, <Y>)</code>
Parameters	<code><X></code> : The x-coordinate of the chosen land location <code><Y></code> : The y-coordinate of the chosen land location.
Pre	The unit is currently flying and is capable of landing on the chosen location.
Post	The unit lands on the chosen location.
Note	The location has to be visible.

3.17 Build addon action

Description	Build the chosen addon.
Syntax	<code>buildAddon(<Name>)</code>
Parameters	<code><Name></code> : The name of the chosen addon.
Pre	The building is capable of building the addon and does not already have the addon.
Post	The building starts constructing the addon.
Note	Only for Terran buildings.

3.18 Load action

Description	Load a unit.
Syntax	<code>load(<ID>)</code>
Parameters	<code><ID></code> : The <i>ID</i> of the unit to load into this (loadable) unit.
Pre	The unit is capable of loading other units inside it and still has enough space provided for the targeted unit.
Post	The targeted unit starts walking to the loadable unit and loads into it.

3.19 Unload action

Description	Unload an unit.
Syntax	<code>unload(<ID>)</code>
Parameters	<ID>: The <i>ID</i> of the unit to unload from this (loadable) unit.
Pre	The unit is capable of loading other units inside it.
Post	The targeted unit is unloaded and stands next to the (loadable) unit.

3.20 Unload all action

Description	Unload all units.
Syntax	<code>unloadAll</code>
Pre	The unit is capable of loading other units inside it.
Post	All units are unloaded and stand next to the (loadable) unit.

3.21 Cancel action

Description	Cancel the construction of the unit.
Syntax	<code>cancel(<Id>)</code>
Parameters	<ID>: The <i>ID</i> of the building/unit to cancel upgrading/morphing etc. Passing no argument will cancel the unit itself.
Pre	The unit is morphing, beingConstructed, researching or upgrading.
Post	The morphing, construction, upgrading or researching is cancelled.

3.22 Patrol action

Description	Patrol an unit between the place it's standing and the given location.
Syntax	<code>patrol(<X>, <Y>)</code>
Parameters	<code><X></code> : The x-coordinate of the chosen location <code><Y></code> : The y-coordinate of the chosen location
Pre	The unit is capable of moving to the chosen location.
Post	The unit patrols between the chosen location (ignoring any other unit it might pass by) and the location it was originally standing.
Note	Medics that are patrolling will automatically heal allies in range.

3.23 Morph action (Zerg only)

Description	Morphs a zerg unit into the another unit.
Syntax	<code>morph(<Type>)</code>
Parameters	<code><Type></code> : The type of unit to morph.
Pre	The unit is capable of morphing into another unit and does have to resources to do so.
Post	The agent terminates and a new agent is created for the new unit.

3.24 Follow action

Description	Follows a unit.
Syntax	<code>follow(<Id>)</code>
Parameters	<code><Id></code> : The Id of the unit to follow.
Pre	The unit is capable of moving.
Post	The unit follows the selected unit.

3.25 Repair action (Terran only)

Description	Repairs a unit with less than the max amount of health. Also works for unfinished buildings.
Syntax	<code>repair(<Id>)</code>
Parameters	<code><Id></code> : The Id of the unit to repair.
Pre	The unit is a SCV, has the resources to repair and can reach the unit to repair.
Post	The SCV starts repairing the selected unit.

3.26 Forfeit action

Description	Forfeits the game.
Syntax	<code>forfeit()</code>
Pre	The game is in progress.
Post	The game ends with a loss.

Chapter 4

Tech Types

All the tech types that can be researched for each race.

4.1 Terran Units

4.1.1 Battle Cruisers

Yamato Gun

4.1.2 Command Centers

Scanner Sweep

4.1.3 Ghosts

Lockdown

Personel Cloaking

Nuclear Strike

4.1.4 Marines and Firebats

Stim Packs

4.1.5 Medics

Healing

Restoration

Optical Flare

4.1.6 Science Vessels

Defensive Matrix

EMP Shockwave

Irradiate

4.1.7 Siege Tanks

Tank Siege Mode

4.1.8 Vultures

Spider Mines

4.1.9 Wraith

Cloaking Field

4.2 Protoss Units

4.2.1 Arbiters

Cloaking Field

Recall

Stasis Field

4.2.2 Corsairs

Disruption Web

4.2.3 Dark Archons

Feedback

Maelstrom

Mind Control

4.2.4 Dark Templars

Dark Archon Meld

4.2.5 High Templars

Archon Warp
Psionic Storm
Hallucination

4.3 Zerg Units

4.3.1 Generic

Burrowing

4.3.2 Defilers

Dark Swarm
Plague
Consume

4.3.3 Hydralisks

Lurker Aspect

4.3.4 Lurkers

Burrowing (Can be used without having it researched)

4.3.5 Queens

Infestation
Parasite
Ensnare
Spawn Broodlings

Chapter 5

Upgrade Types

All the upgrade types that can be used for each race.

5.1 Terran Units

5.1.1 Academy

U-238 Shells
Caduceus Reactor

5.1.2 Armory

Terran Vehicle Weapons
Terran Vehicle Plating
Terran Ship Weapons
Terran Ship Plating

5.1.3 Covert Ops

Ocular Implants
Moebius Reactor

5.1.4 Engineering Bay

Terran Infantry Weapons
Terran Infantry Armor

5.1.5 Machine Shop

Ion Thrusters
Charon Boosters

5.1.6 Physics Lab

Colossus Reactor

5.1.7 Science Facility

Titan Reactor

5.1.8 Control Tower

Apollo Reactor

5.2 Protoss Units

5.2.1 Arbiter Tribunal

Khaydarin Core

5.2.2 Citadel of Adun

Protoss Plasma Shields
Leg Enhancements

5.2.3 Cybernetics Core

Singularity Charge
Protoss Air Weapons
Protoss Air Armor

5.2.4 Fleet Beacon

Apial Sensors
Gravitic Thrusters
Argus Jewel
Carrier Capacity

5.2.5 Forge

Protoss Plasma Shields

Protoss Ground Armor

Protoss Ground Weapons

5.2.6 Observatory

Gravitic Boosters

Sensor Array

5.2.7 Robotics Support Bay

Reaver Capacity

Scarab Damage

Gravitic Drive

5.2.8 Templar Archives

Argus Talisman

Khaydarin Amulet

5.3 Zerg Units

5.3.1 Defiler Mound

Metasynaptic Node

5.3.2 Evolution Chamber

Zerg Melee Attacks

Zerg Missile Attacks

Zerg Carapace

5.3.3 Hydralisk Den

Muscular Augments

Grooved Spines

5.3.4 Lair and Hive

Ventral Sacs

Antennae

Pneumatized Carapace

5.3.5 Queen's Nest

Gamete Meiosis

5.3.6 Spawning Pool

Metabolic Boost

Adrenal Glands

5.3.7 (Greater) Spire

These are the upgrade type(s) the (Greater) Spire offers.

Zerg Flyer Carapace

Zerg Flyer Attacks

5.3.8 Ultralisk Cavern

These are the upgrade type(s) the Ultralisk Cavern offers.

Chitinous Plating

Anabolic Synthesis

Chapter 6

Unit Types

StarCraft's unit types.

6.1 Terran Units

6.1.1 Terran Ground Units

Terran Firebat
Terran Ghost
Terran Goliath
Terran Marine
Terran Medic
Terran SCV
Terran Siege Tank
Terran Vulture
Terran Vulture Spider Mine

6.1.2 Terran Air Units

Terran Battlecruiser
Terran Dropship
Terran Science Vessel
Terran Valkyrie
Terran Wraith

6.1.3 Terran Building Units

Terran Academy
Terran Armory
Terran Barracks
Terran Bunker
Terran Command Center
Terran Engineering Bay
Terran Factory
Terran Missile Turret
Terran Refinery
Terran Science Facility
Terran Starport
Terran Supply Depot

6.1.4 Terran Addons

Terran Comsat Station
Terran Control Tower
Terran Covert Ops
Terran Machine Shop
Terran Nuclear Silo
Terran Physics Lab

6.2 Protoss Units

6.2.1 Protoss Ground Units

Protoss Archon
Protoss Dark Archon
Protoss Dark Templar
Protoss Dragoon
Protoss High Templar
Protoss Probe
Protoss Reaver
Protoss Scarab
Protoss Zealot

6.2.2 Protoss Air Units

Protoss Arbiter
Protoss Carrier
Protoss Corsair
Protoss Interceptor
Protoss Observer
Protoss Scout
Protoss Shuttle

6.2.3 Protoss Building Units

Protoss Arbiter Tribunal
Protoss Assimilator
Protoss Citadel of Adun
Protoss Cybernetics Core
Protoss Fleet Beacon
Protoss Forge
Protoss Gateway
Protoss Nexus
Protoss Observatory
Protoss Photon Cannon
Protoss Pylon
Protoss Robotics Facility
Protoss Robotics Support Bay
Protoss Shield Battery
Protoss Stargate
Protoss Templar Archives

6.3 Zerg Units

6.3.1 Zerg Ground Units

Zerg Broodling
Zerg Defiler
Zerg Drone
Zerg Egg
Zerg Hydralisk
Zerg Infested Terran
Zerg Larva

Zerg Lurker
Zerg Lurker Egg
Zerg Ultralisk
Zerg Zergling

6.3.2 Zerg Air Units

Zerg Cocoon
Zerg Devourer
Zerg Guardian
Zerg Mutalisk
Zerg Overlord
Zerg Queen
Zerg Scourge

6.3.3 Zerg Building Units

Zerg Creep Colony
Zerg Defiler Mound
Zerg Evolution Chamber
Zerg Extractor
Zerg Greater Spire
Zerg Hatchery
Zerg Hive
Zerg Hydralisk Den
Zerg Infested Command Center
Zerg Lair
Zerg Nydus Canal
Zerg Queens Nest
Zerg Spawning Pool
Zerg Spire
Zerg Spore Colony
Zerg Sunken Colony
Zerg Ultralisk Cavern