# SmartGarden – Multi-Station Processing Logic

### Introduction

SmartGarden Master Controller can handle multiple stations – it allows connecting multiple remote stations to a single Master, and then centrally schedule watering and collect sensors readings across the network.

Remote stations could be connected to the Master using variety of means – XBee network, nRFL RF network, wired RS485 connections etc. Single Master controller can handle multiple remote stations connected via multiple hookups.

In addition to Remote stations, Master controller can also drive multiple channels directly connected to it – using direct parallel IO (Positive or Negative), and using OpenSprinkler-type serial interface. Master controller also may have sensors (e.g. Temp sensors, Waterflow sensors etc.) connected directly to the master.

### Entities Hierarchy

Internally Master controller maintains hierarchy of entities and topology information. This data is stored in EEPROM, and is required for many of the Master controller functions.

**Hierarchy:**

* Master controller has a list of Stations

Each Station entity represents a separate physical or logical Station. Each Station may have zero or more watering control channels, and may have various sensors connected to it.

Each Station has a unique ID – simple integer number (e.g. 1, 2, 3 etc), this ID is manually assigned to each station. The station also has a user-friendly Name, which can be assigned to the station using Master controller WEB UI, for convenience of referring to it in various UIs and reports.

Each Station may have up to 8 channels of watering control. If physical station has more than 8 channels connected, logically it is represented as two or more Stations.

In UIs StationID is represented as a single hexadecimal digit (0 to 9 and A to F).

Master controller itself is also a Station, and is assigned a pre-defined ID(s). Depending on the number of directly connected channels Master controller can be represented by more than one Station (up to 8 channels each). By default Master station is assigned ID of zero. If Master station has more than 8 watering channels connected, these additional channels (above 8) are represented as logical stations A, B, C, D, E, F. Remote stations usually are assigned IDs of 1 to 9 – allowing one Master to control up to 9 remote stations in addition to channels physically connected to the Master controller.

Each remote Station is connected to the Master via a network. Because Master can support multiple networks, we keep track of the NetworkID and NetworkAddress for each station, to be able to quickly locate the Station. Full address of a Station is NetworkID:StationAddress.

Local Station is also connected to a built-in “localhost” network with reserved ID of zero.

For convenience of addressing Stations are usually addressed by StationID directly (StationID is globally unique for a particular setup). Internally StationID can be quickly translated into NetworkID:StationAddress using config information in Master EEPROM.

From the user point of view NetworkID and StationAddress are not directly visible (although can be obtained as a diag information – analogous to Network Interface and MAC address), usually user is working with Stations using StationID and user-friendly Station Name.

* Out of all available watering channels connected to various stations Master controller creates a common list of Zones.

Each Zone is a logical watering channel. For convenience of usage each Zone is given a user-friendly name (using Master’s WEB UI).

Each Zone is mapped to a specific Station and Channel on that station. This mapping is a part of the config information. For each Zone we keep track of the StationID and Channel this zone is mapped to.

* Schedules are operating with Zones, and are unaware of the actual Zone mapping.

Stations list and mapping topology (Zones to Station/Channel mapping) is stored in EEPROM, and is originally loaded from a config file (.ini file). Since right now I don’t have plans to create a WEB editor for this config, system re-configuration can be accomplished by initiating config reload from the WEB UI.

The system also includes mechanism for automatic reconfiguration – Master controller can scan RF networks (on a given PAN ID) and can automatically import all stations on that network, querying each station configuration.

It is important to mention that NetworkIDs are pre-defined (they are based on network types), and Network Addresses are assigned by the config.