

FMS Light User's Guide

Overview

FMS Light is a software tool for basic control of FRC robots. It allows the operator to enable and disable robots in Autonomous and Teleoperated modes, as well as set timers for the duration of each mode. The user interface is shown in Figure 1. It can be used to test the operation of a single robot in both Autonomous and Teleoperated mode, or is can be used to administer a pre-season or post-season FRC event.

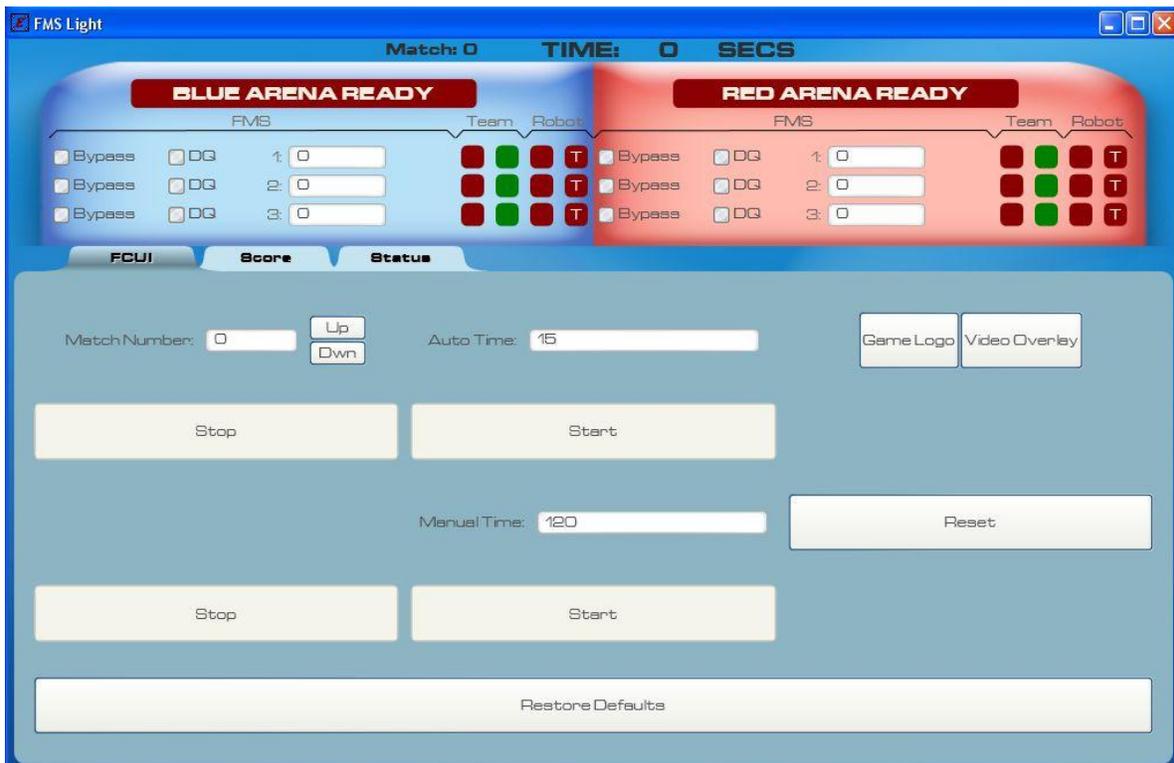


Figure 1: FMS Light Main Screen

System Requirements

- Microsoft Windows PC – FMS Light has been tested on Windows XP SP3 and Windows Vista. The Audience program can be run on the same PC as FMS Light (dual monitors recommended) or on a separate computer.
- Microsoft .NET Framework 3.5 SP1, available via [this link](#). To determine which version of the .NET Framework is currently installed on your PC, visit [this website](#).
- Windows Firewall *must be disabled* to ensure that all necessary ports be open between the Driver Stations and FMS Light.
- Disable any third-party firewall or Internet Security software that blocks port traffic.

Installation

1. Download the FMS Light installer from the [2009 FRC Control System website](#).
2. Run the installer
3. Execute FMS Light using the icon on the Desktop, or from the Start menu via Start->Program Files-> FIRST->FMS Light
4. Execute the Audience screen program from the Start menu via Start->Program Files-> FIRST->Audience

Control Indicators

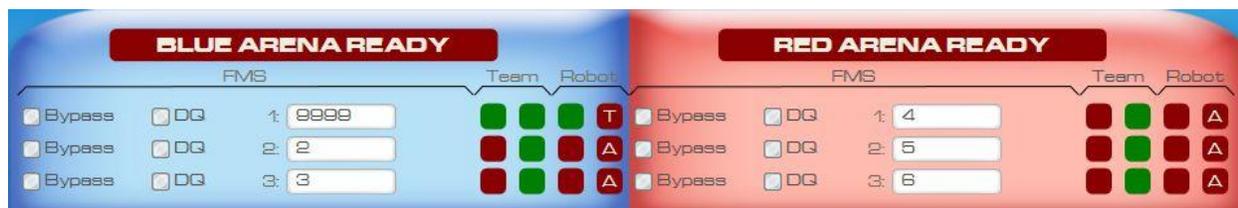


Figure 2: Control Indicators

The top of the FMS Light screen indicates the status of the robots at each end of the playing field and is divided according to Alliance color. Each box includes information on the status of the three robots on each Alliance. All bubble indicators include fly outs, simply hover your mouse pointer over the bubble to show details on the information it tells the user.

The information for each Alliance is broken down into three groups, FMS, Team, and Robot.

- FMS – controls to inform FMS Light which robot in the indicated station position and how to handle it.
 - Bypass – Select this box to bypass this particular station and force it to an enable state.
 - DQ – Same functionality as Bypass

- Team Number – Type in the team number which corresponds with this station. Team numbers need to be in the correct station to ensure the team receives the proper Station ID and Position information from FMS Light.
- Team – indicates the state of the DS.
 - Left bubble – Indicates status of the FMS-to-DS link. If the team number and DS match, this bubble will be green.
 - Right bubble – Indicates status of the DS E-stop state, this bubble will always be green when using FMS Light.
- Robot – indicates the state of the Robot.
 - Left bubble – DS-to-Robot link status. If the DS and Robot are linked, this bubble will be green. If the station has been Bypassed, a “B” will appear in this bubble.
 - Right bubble – Mode and System state of the Robot. “A” indicates Autonomous Mode, “T” indicates Teleoperated mode. If the Robot is disabled, the bubble is red, it will be green when the Robot is enabled by FMS Light.

Robot Control Panel

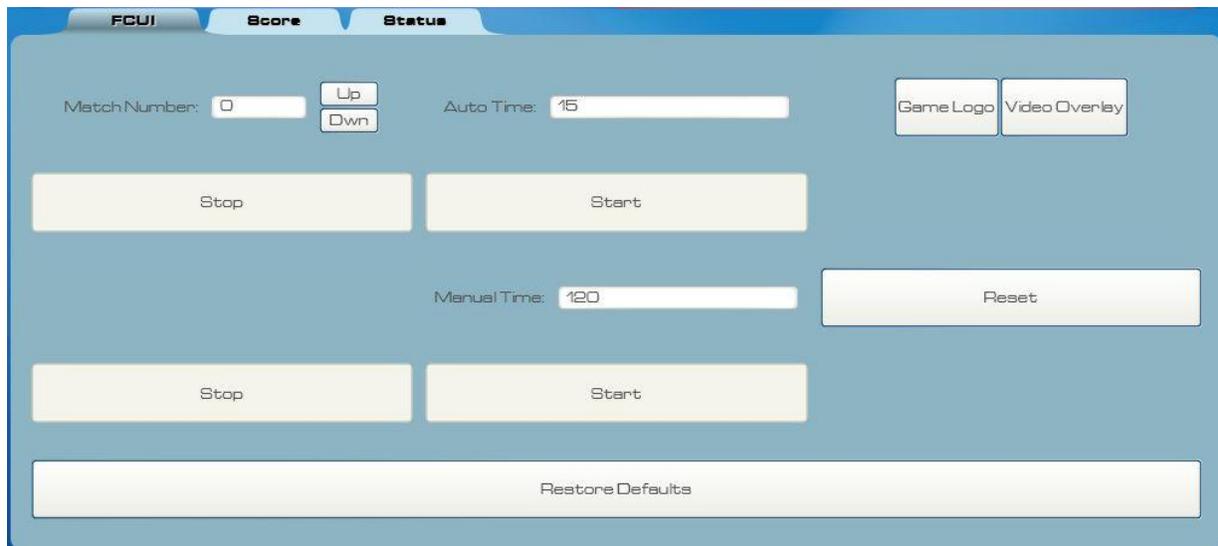


Figure 3: Control Panel

The bottom half of the main FMS Light screen, under the FCUI tab, allows for the control of the Robots. The button functions are:

- Upper Stop – stop Autonomous Mode. All robots are set to Autonomous-Disabled. The timer is stopped. Resume match by pressing Upper Start button.
- Upper Start – start a Full Match. All robots are set to Autonomous-Enable. The timer begins counting down, the duration is determined by the value in the Auto Time field. Robots are set to Autonomous-Disable when the timer stops, then Teleop-Disable, then Teleop-Enable. The timer begins to count down again based on the value in the Manual Time field. When the manual time ends, robots are set to Teleop-Disable.

- Lower Stop - stop Teleoperated Mode. All robots are set to Teleop-Disabled. The timer is stopped. Resume match by pressing Lower Start button.
- Lower Start – start the robot in Teleoperated Mode. Timer will countdown based on the value in the Manual Time field.
- Reset – return the current mode to the default state. All robots are set to Autonomous-Disable state. Pressing Reset requires that the user re-enter any Bypassed station at the top of the screen.
- Restore Defaults – Restore the timers to the default values of 15 seconds (Auto Time) and 120 seconds (Manual Time).
- Match Number – Use the Up and Down buttons to indicate the current match number. This number will update on the Audience screen when the match starts or when Reset is pressed.
- Game Logo – Press this button to show the Lunacy logo on the Audience screen
- Video Overlay – Press this button to show the timer, team numbers, and score on the Audience screen.

Enter the duration for each operating period. **The robot control panel will only allow the user to press “Start” once there is a defined state for each station on both Alliances.** In the case of Figure 2, there is only 1 robot, in order to start the match the other stations must be Bypassed, as shown in Figure 4.

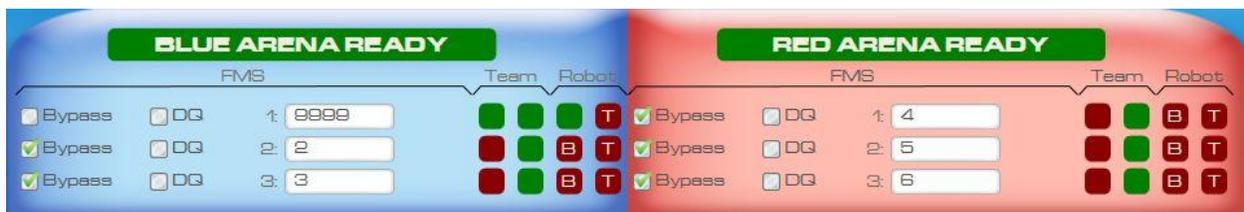


Figure 4: Match Ready State

The Match Ready state for each Alliance is confirmed when each “Arena Ready” changes from red to green.

Field Status

Station	Robot IP		Robot MAC		Status		
	FMS	DS	FMS	DS	DS	Robot	
Blue 1	10.99.99.2	10.99.99.2		00-80-2F-11-10-5D	●●●●●●	●●●●●●	12.07
Blue 2	10.0.2.2				●●●●●●	●●●●●●	○
Blue 3	10.0.3.2				●●●●●●	●●●●●●	○
Red 1	10.0.4.2				●●●●●●	●●●●●●	○
Red 2	10.0.5.2				●●●●●●	●●●●●●	○
Red 3	10.0.6.2				●●●●●●	●●●●●●	○

Station	Team ID		DS Comm Version		Errors		Robot QOS		
	FMS	DS	FMS	DS	DS	Robot	Avg Trip	Missed Count	Total Count
Blue 1	9999	9999	06250846	06250846	●●●●●●	●●●●●●	○	○	○
Blue 2	2	0	06250846		●●●●●●	●●●●●●	○	○	○
Blue 3	3	0	06250846		●●●●●●	●●●●●●	○	○	○
Red 1	4	0	06250846		●●●●●●	●●●●●●	○	○	○
Red 2	5	0	06250846		●●●●●●	●●●●●●	○	○	○
Red 3	6	0	06250846		●●●●●●	●●●●●●	○	○	○

Figure 5: FMS Light Field Status Display

Click on the Status tab shows detailed information for each robot linked to FMS Light. Rows highlighted in yellow indicate a mismatch between the data that FMS Light expects vs. the data it receives from the DS. This version of FMS Light expects the DS firmware version to be 090210a3

The top half of the screen includes these details:

- Station: Alliance station
- Robot IP: FMS – The IP that FMS expects based on the team number entered.
- Robot IP: DS – The robot IP reported to FMS Light.
- Robot MAC: FMS – unused currently
- Robot MAX: DS – The MAC address of the robot reported to FMS Light.
- Status: DS – Indicates the status of the DS (link active, in competition mode, enable/disable, etc.) Each bubble includes a fly out with details on what it is indicating.
- Status: Robot – Indicates the status of the Robot (link active, mode, enable/disable, and battery voltage). Each bubble includes a fly out with details on what it is indicating. Note that battery voltage is only indicated if the appropriate jumper is connected on the Analog Breakout in slot 1 of the cRIO.

The bottom half of the Status screen indicates these details:

- Team ID – Team number as indicated on FMS Light, and the status message from the DS.
- DS Comm Version – The communications protocol version as expected by FMS Light, and reported by the DS. If these do not match, FMS Light will not enable the Robot.
- Errors – Various errors as reported by the DS to FMS Light. Fly over the bubbles to see more details of each error.
- Robot QOS – These fields indicate Quality-of-Service data. Upon power up, the DS starts a counter which FMS tracks.
 - Avg Trip – Indicates the average trip time (in milliseconds) to send a status packet from the DS-to-Robot-to-DS. This number is typically 20-25ms during an FRC Regional event.

- Missed Count – indicates the number of packets dropped in the DS-to-Robot link. Typically there are some lost packets. In a very tame wireless environment, this number will be less than 100.
- Total Count – The total number of packets sent by the DS to the Robot. This number is a 16-bit signed integer, i.e. the maximum value will be 32,767. If this count is exceeded, the value becomes 0. It takes approximately 10 minutes for the counter to reach 32,767.

Score

Team #0	Rock	Cell	Team #0	Rock	Cell		
0	0	0	0	0	0		
0	0	0	0	0	0		
0	0	0	0	0	0		
Score	Bonus	Penalty	Final	Score	Bonus	Penalty	Final
0	0	0	0	0	0	0	0

Figure 6: FMS Light Score Display

Match Scores shown on the Audience Screen are entered using fields under the Score tab. Enter the value in the field, then click outside the field for the data to be update on the Audience Screen. *Note that this data is only for display purposes; FMS Light does not contain a database to store these values.*

Audience Screen

The Audience screen is show below in both available display options

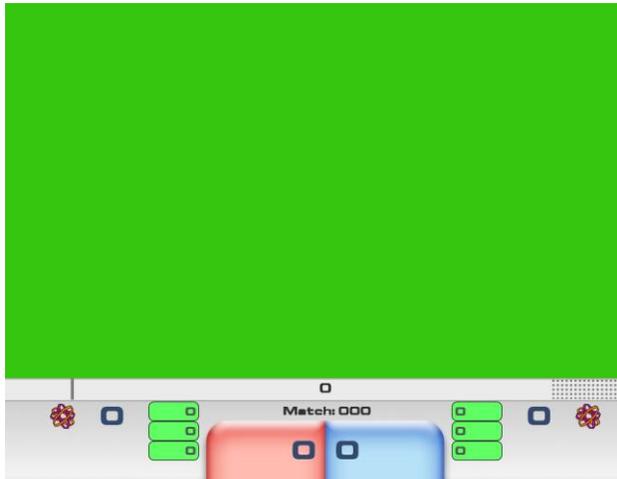


Figure 7: Audience screen with Video Overlay



Figure 8: Audience screen showing Game Logo

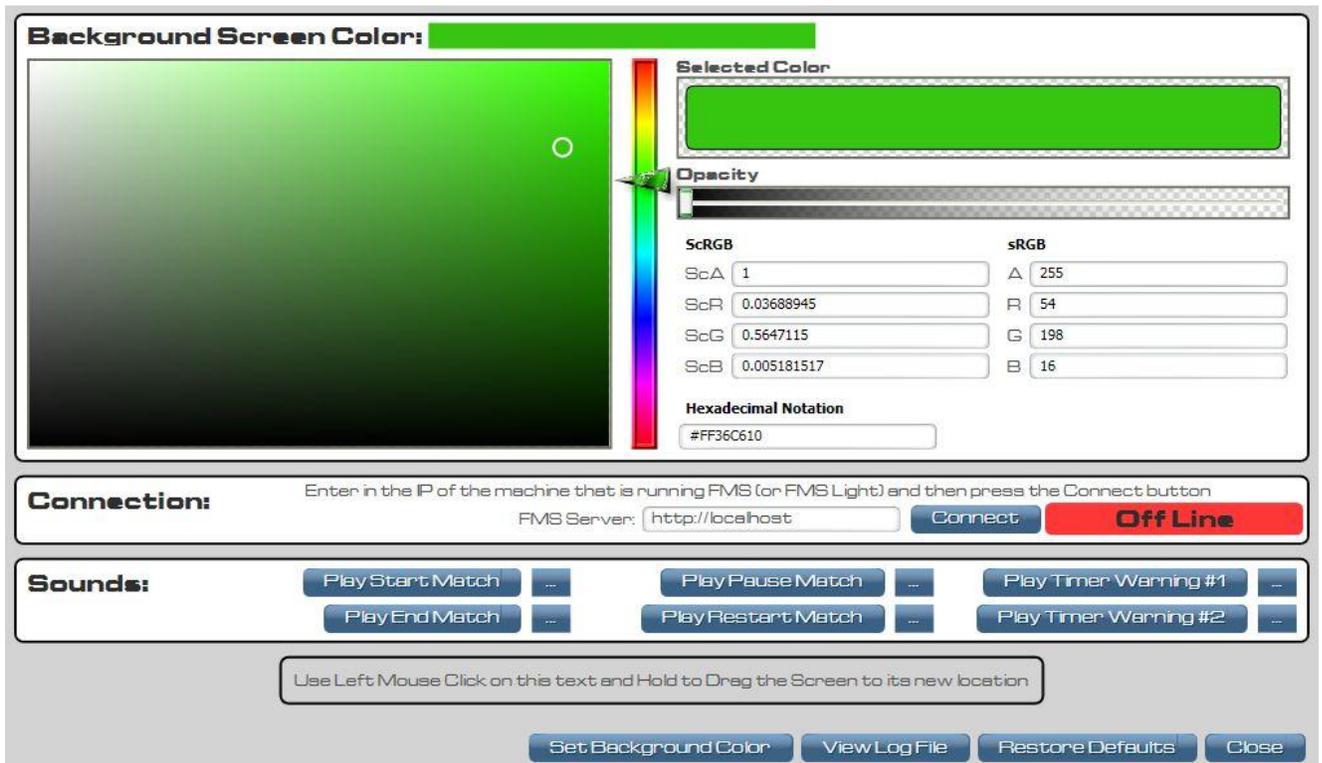


Figure 9: Audience Screen Configuration

The Audience screen configuration page can be accessed by pressing CTRL-SHIFT-F12. There are several options on this configuration screen:

- Background Screen Color – This defines the background screen color when using Video Overlay. Choose the background color from the palette, or input the specific ScRGB or RGB values for the color, then click the Set Background Color button at the bottom of the page.
- Connection – Use this configuration area to indicate the IP of the PC running the FMS Light program. Use the Connect button to verify that the link is operating correctly.
- Sounds – this area defines the sounds used during a match. The default sounds are those you would expect to hear at a typical FRC Regional. Select the “...” button to select alternative sounds. Click Restore Defaults to return to the standard FRC sounds.

Event Setup when using FMS Light

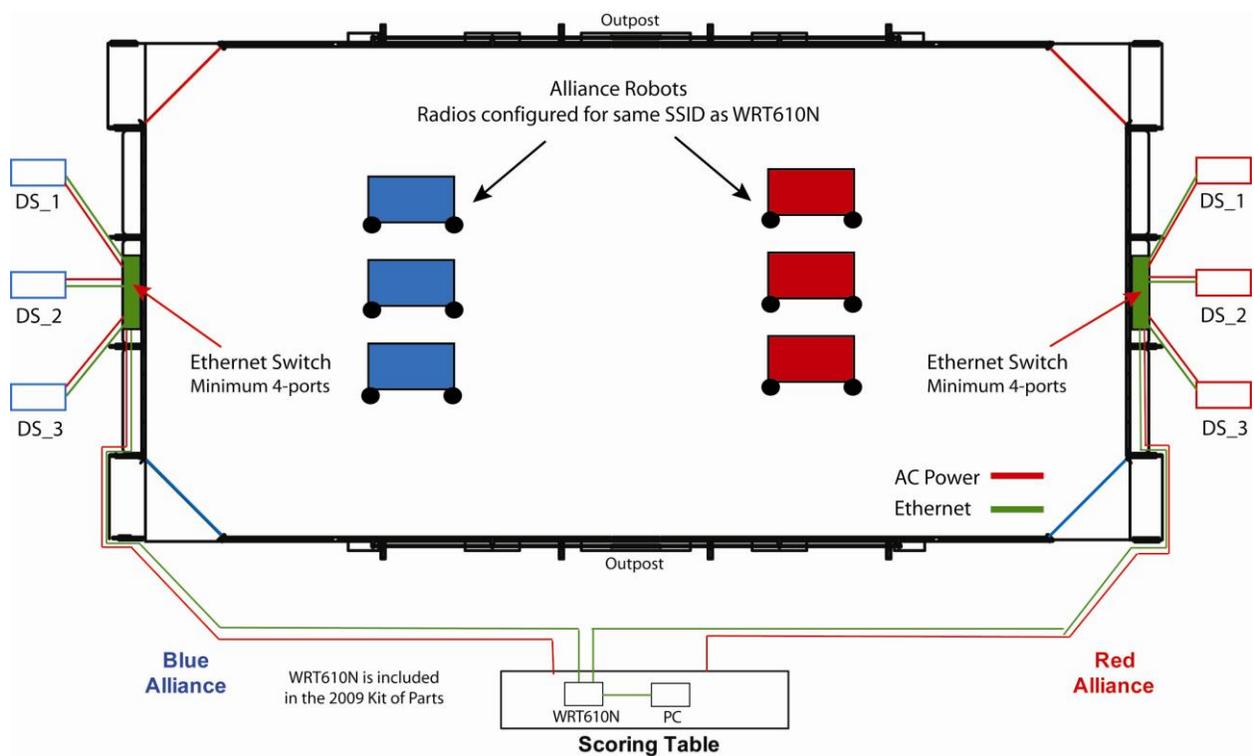


Figure 10: FMS Light field setup

FMS Light requires minimal field hardware when used to administer an FRC pre-season or post-season event. The recommended minimum list of hardware includes:

- 6 Driver Stations w/ power supplies
- 6 Robots with WGA600N radios
- 2 Ethernet switches (1 Ethernet switch could be used, but will require longer lengths of Ethernet cable to reach each DS)
- 1 WRT610N
- 1 PC running FMS Light (see minimum requirements above)
- 9 Ethernet cables (6 to connect DS's to field end switches, 2 to connect each field end switch to the WRT610N (min 50ft), and 1 to connect PC to WRT610N)

Configuration of the WGA600N and WRT610N is at the discretion of the event organizer. *FIRST* recommends that these radios be set to operate in the 5GHz frequency band, using the 802.11n standard, as is shown in the [2009 FRC Control System manual](#). Note that a single SSID will need to be chosen for the WRT610N and this SSID will need to be programmed into each WGA600N radio.

Generating a Match Schedule

FMS Light does not include the functionality to generate a match schedule. The details below outline how to use Microsoft Excel with a readily available match generation algorithm to create a schedule. This is only one of many algorithms that can be implemented to create a tournament schedule.

This procedure utilizes the MatchMaker algorithm, created by Idle Loop Software, the same algorithm used to create match schedules at FRC Regional events and the FRC Championship. Details on MatchMaker are available at the Idle Loop web site; www.idleloop.com/matchmaker.

PLEASE NOTE: Idle Loop Software allows anyone to use MatchMaker for a *FIRST*-related competition. *For any other purpose, it is necessary to obtain prior permission from Idle Loop Software.*

MatchMaker is a console application; it is run from the command prompt in Microsoft Windows and its output can be redirected to a text file which Excel can read. A Mac version is also available.

Running the command "MatchMaker" (no quotes) from the command prompt will produce the help info with sample command lines.

The command line below is an example for a tournament with these parameters:

- 37 teams
- 7 rounds per team
- Team numbers are loaded from a file called teams.txt in the current directory
- Best schedule quality (longest compute time)
- Surrogate matches in round 3
- Quiet (no extraneous output)
- Sparse format
- Resulting schedule written to a text file called "matches.txt" in the current directory.

```
MatchMaker -t 37 -r 7 -l teams.txt -b -u 3 -q -s > matches.txt
```

FIRST and Idle Loop Software recommend using the "best" quality, -b. Schedules generated with the lower quality settings will not be as good, the main effect being that each team will not play with the maximum number of alliance partners and opponents.

The Sparse Output Format is limited in the amount of data output. For each match this format shows the Match Number, and then red team #1 followed by 0 for a normal appearance or 1 for a surrogate appearance, then red team #2, 0 or 1, then red team #3. The three blue teams are shown in the same pattern.

The Sparse Output Format is space-delimited. An extra step is necessary to split the values for each match into columns. In Excel, these are the steps:

1. Open the file
2. A dialog box will ask how to interpret the text
3. Choose delimited, then check "space" as a delimiter

If the dialog box asking how to interpret the text does not appear after opening the file, and all of the text gets dumped into a single column, you can still split the text into columns. The steps are:

1. Select all of the text
2. Use the "Text to Columns" command from the Data menu to tell Excel to use space delimiters to break the lines into columns.

Omitting the -s "Sparse Output Format" option produces a text file with surrogate appearances marked with an asterisk (*) instead of the extra 0/1 columns. This format lists the Match Statistics as well as the schedule. Use these statistics to decide if the schedule meets your criteria, then delete all text but the schedule and load that into Excel using the steps outlined above, again as space-delimited fields.