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2 Teams 19 & 20: Communications Protocol

3 Specification Document

4 Laboratory #2: Requirements and Specification

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12 *Work Product*

13 This document describes the communication protocol implemented by Teams 19 and
14 20 for communication between the base station control system, and the robot. This
15 document describes the creation, and decoding process for messages.

16

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18 2/15/2013 created
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22

Approval Sheet

All group members whose names are listed below approve of the document and contributed fairly.

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On my honor, as a student, I have neither given nor received unauthorized aid on this assignment.

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88 **Introduction**

89 **About**

90 This document describes the protocol used to communicate between robot and base
91 station system. This protocol allows the base station to control the robot, and allows
92 the robot to send messages including errors to the base station.

94 **Protocol Description**

95 This protocol uses 10-character messages to communicate between the robot and
96 the base station. These 10-character messages encode both commands from the
97 base station to the robot and messages from the robot to the base station. The
98 messages are structured such that the first two characters determine the type of
99 command or message. The remaining characters are used for various parameters
100 that are documented below.

101

102 Base Station to Robot Messages

103 Command Structure

104 Commands are 10-character messages, where the first two characters are the
105 command type. The remaining characters represent parameters to the command,
106 used by the robot to determine how to execute the command.

107 No-Op

108 **Message:** 0000000000

109 **Description:** This command is the no operation command can be used to test if
110 messages are being sent. This message is a “null” message.

111 Move Straight

112 **Command Type:** MS

113 **Parameters:** Forward/Backwards, and distance.

114 Byte 2 is forward or backwards (F/B)

115 Bytes 3-9 is distance (#), can be null (0s)

116 **Description:** This command moves the robot in a straight line. The
117 forward/backward parameter control the direction the robot will move in. The
118 distance allows for the robot to move a specified distance, this parameter can be
119 null. If distance is null, the robot will continually move

120 **Example Commands:**

121 MSF0000000 will move the robot forward continuously.

122 MSB0001000 will move the robot backwards 1000 units.

123 Move Arc

124 **Command Type:** MA

125 **Parameters:** Forward/Backwards, left/right, radius, distance

126 Byte 2 is forward or backwards (F/B)

127 Byte 3 is left or right (L/R)

128 Byte 4-6 is radius (# degrees)

129 Byte 7-9 is distance (#), can be null (0s)

130 **Description:** This command moves the robot in an arc. The forward/backward
131 parameter control the direction the robot will move along the arc. Left/Right will
132 control the direction the robot arcs to. Radius is the absolute value of the number of
133 degrees to move. The distance allows for the robot to move a specified distance, this
134 parameter can be null. If distance is null, the robot will continually move until
135 stopped.

136 **Example Commands:**

137 MAFL090000 will move the robot forward to the left along a 90 degree curve
138 continuously

139 MABR030100 will move the robot backwards along a 30 degree curve for
140 100 units.

141

142 **Turn**

143 **Command Type:** TN

144 **Parameters:** Left/Right, and radius

145 Byte 2 is left or right (L/R)

146 Byte 3-9 is radius (# degrees), can be null (0s)

147 **Description:** This command turns the robot when stationary. The Left/Right

148 parameter determines the direction the robot turns. The Radius parameter is an

149 absolute value that determines how far the robot turns. If the radius is null, the

150 robot continually turns until stopped.

151 **Example Commands:**

152 TNR0000090 will turn the robot right 90 degrees

153 TNL0000000 will turn the robot left continuously

154 **Stop**

155 **Message:** ST00000000

156 **Description:** This command stops any actions that the robot is currently doing. This

157 will end any movement actions.

158 **Read Sensor**

159 **Command Type:** RS

160 **Parameters:** Sensor Port

161 Byte 2 is sensor type (U for Ultrasonic, T for touch, M for sound, L for light)

162 Bytes 3-9 are 0

163 **Description:** This command will read a specified sensor. The Sensor Port parameter

164 will determine which sensor to read the value of.

165 **Example Commands:**

166 RSU0000000 will cause the robot to read the value of the sensor, and send

167 the data to the base station.

168 **Set Speed**

169 **Command Type:** SS

170 **Parameters:** Motor/Motor Combination, and new speed.

171 Byte 2 is Motor/Motor combination (A for Motor A, B for Motor B, C for

172 Motor C, D for Drive Motors)

173 Bytes 3-9 is the new speed

174 **Description:** This command will change the speed of the motors. The combination

175 will determine which motors or combinations of motors to change the speed for.

176 **Example Commands:**

177

178 **Read All Sensors**

179 **Command Message:** RA00000000

180 **Description:** This command tells the robot to read all sensors and send the data.

181 Each sensor's data will be sent to the base station in a separate message.

182 Robot to Base Station Messages

183 Acknowledgment

184 **Description:** This message is sent to the base station as acknowledgment of
185 receiving a command.

186 **Message:** AK00000000

187 Error Messages

188 Sensor Error Messages

189 **Message Type:** ERS

190 **Parameters:** Message number

191 Bytes 3-9 message number

192 **Description:** This message will tell the base station that an error with a sensor has
193 occurred. The message number maps to a more specific description, that the base
194 station will have stored locally for reference. Available messages can be seen in a
195 table below, which will have additions added as required.

196

Message Number	Description
0000001	Error with sensor in port 1
0000002	Error with sensor in port 2
0000003	Error with sensor in port 3
0000004	Error with sensor in port 4

197

198 Motor Error Messages

199 **Message Type:** ERM

200 **Parameters:** Message Number

201 Bytes 3-9 message number

202 **Description:** These messages will tell the base station that an error with a motor
203 has occurred. The message number correlates to a specific description, which the
204 base station has stored locally. Available messages can be seen in a table below,
205 which will have additions added as required.

206

Message Number	Description
0000001	Error with motor in port A
0000002	Error with motor in port B
0000003	Error with motor in port C

207

208 Sensor Data Messages

209 **Message Type:** SD

210 **Parameters:** Sensor Type, and Data

211 Byte 2 sensor type (U for Ultrasonic, T for Touch, M for Sound, or L for Light)

212 Bytes 3-9 sensor data

213 **Description:** These messages allow for the robot to send data to the base station
214 based on the values of the sensor.