

Wallace Monitor Program
for the
68HC11 Microcontroller / Wallace Robot

Monitor Version 2.0
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DISCLAIMER:

This software is provided “as is” and without any express or implied warranties, including, without limitation, the implied warranties of merchantability and fitness for a particular purpose.

COMPATABILITY:

This software has been created and tested using the following development systems:

Compiler(s):

GCC 68HC11 compiler version 2.2

Processor(s):

Motorola 68HC11 E1 operating at 2 MHz E-clock

Evaluation Board(s):

Axiom Manufacturing CMM11E1-EVBU

Hardware:

Wallace Robot, School of Engineering, GVSU

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1 Overview

The Wallace monitor program was designed to allow the user to quickly and easily access and control the various I/O boards on the Wallace robot. The monitor program is stored in the external ROM on the microcontroller board. The reset vector on the 68HC11 has been programmed such that the Wallace monitor program executes when the microcontroller is first powered up and after a reset.

User interface with the monitor program is provided via serial communication and a command line prompt. The following message is displayed when the monitor program first executes.

```
Wallace Boot Image
  Version: 2.0
  Created: Nov 6 2006
Type ? for help
WALLACE>
```

To see a list of the available commands type “?”. To exit the Wallace monitor program type “quit” at the prompt. Exiting the Wallace monitor program will cause execution to be passed to the BUFFALO monitor program. The BUFFALO monitor program is the standard monitor program for the 68HC11 and allows direct access to memory, I/O registers, and the ability to download and execute S19 files. To return to the Wallace monitor program, type “GO 8000” at the BUFFALO prompt.

2 Specifications and I/O Usage

The Wallace monitor program was developed based on the Wallace library functions. As such, it is designed for a fixed configuration of the I/O boards. Failure to properly connect the I/O boards will result in incorrect operation of the monitor program and possible hardware damage. The list of required I/O connections between the various I/O boards and the microcontroller board along with the corresponding wiring diagram are shown in the Appendix.

3 Special Operating Modes

Several special operating modes are available on the Wallace monitor program. In order to enter the special operating modes, pin PA1 must be pulled up to +5V. This can be done by inserting a jumper wire from the PA1 pin to the +5V pin on the MCU_PORT of the microcontroller board as illustrated in Figure 1. These jumper wires are stored with the Wallace robot supplies. Each of the special operating modes is described in the following sections.

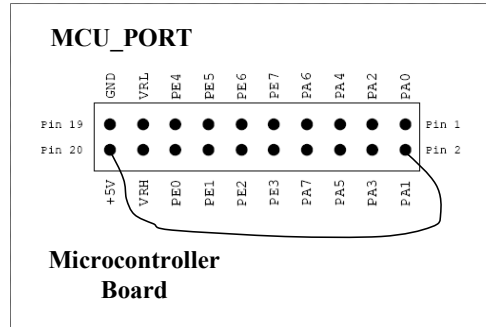


Figure 1: Special Operating Mode Jumper Connection

3.1 Selectable Control Mode

To enter this mode, simply connect PA1 to +5V and turn on the robot (or press the reset button). Both of the LEDs will come on for 1 second and then begin to flash on and off. This indicates that the monitor program is in the selectable control mode. There are three options available in this mode. Each of these options is selected by pressing a specific button combination on the Analog/Digital I/O board. When the selected option is finished executing, the monitor program will return to the selectable control mode. The following is a description for each of the available options.

3.1.1 Variable Time Control Option

To select this option press button 1 (the button closest to the LEDs). The yellow LED will come on for 3 seconds. This gives you time to get your hands away from the robot. The green LED will then turn on while the motors are activated for a variable time duration. After the time has elapsed, the motors will turn off and the LEDs will revert to the flashing pattern. The potentiometer controls how long the motors are turned on for. When the potentiometer is turned fully counter clockwise, the motors will run for 1 second. When it is turned fully clockwise, the motors will run for 5 seconds. The motors will always be enabled at 100% duty cycle (full voltage).

3.1.2 Variable Speed Control Option

To select this option press button 2 (the button away from the LEDs). The yellow LED will come on for 3 seconds. This gives you time to get your hands away from the robot. The green LED will then turn on while the motors are activated at a variable duty cycle. After the fixed time has elapsed, the motors will turn off and the LEDs will revert to the flashing pattern. The potentiometer controls how fast the motors turn. When the potentiometer is turned fully counter clockwise, the motors will be enabled at 25% duty cycle. When it is turned fully clockwise, the motors will be enabled at 100% duty cycle (max voltage). The motors will always be turned on for 5 seconds.

3.1.3 Obstacle Detection Control Option

To select this option press button 1 and button 2 at the same time. The yellow LED will come on for 3 seconds. This gives you time to get your hands away from the robot. The

green LED will then turn on and the robot will start moving forward. It will continue to move forward until an IR signal is received. Once an IR signal is detected, the robot will stop for 0.5 seconds, turn left for a variable time duration, wait 0.5 seconds, and then begin moving forward again. This process will repeat until both buttons are pressed at the same time. At that point the motors will turn off and the LEDs will revert to the flashing pattern. The potentiometer controls how long the motors are enabled when making a turn (0 to 1 seconds). The motors will always be enabled at 100% duty cycle (full voltage).

The IR transmitter is enabled in this option so that it can be used along with the IR receiver to detect obstacles. Infrared light from the transmitter will bounce off an object and be reflected back to the receiver. This allows the robot to detect when there is an obstacle in front of it. However, in order for it to work properly, the IR transmitter and receiver must be positioned properly on the front of the robot.

3.2 Infrared Remote Control Mode

To enter this mode, connect PA1 to +5V and turn on the robot (or press the reset button) while holding down both buttons. Both of the LEDs will come on and stay on. This indicates that the monitor program is in the infrared remote control mode. If they start flashing you did not hold down both buttons.

In this mode the monitor program will check the IR receiver for signals from an infrared remote. It is programmed to only recognize the STARVISION remote control. These remotes are stored with the Wallace robot supplies. Table 1 lists the implemented remote control buttons and the corresponding robot commands.

Table 1 : Infrared Remote Control Commands

Remote Control Button	Command
Up arrow	Moves forward
Down arrow	Moves backwards
Left arrow	Turns left
Right arrow	Turns right
SELECT	Stops
Zoom +	Increases left motor speed
Zoom -	Decreases left motor speed
Volume +	Increases right motor speed
Volume -	Decreases right motor speed
Focus +	Turns on LED 1 (yellow)
Focus -	Turns off LED 1 (yellow)
Bright +	Turns on LED 2 (green)
Bright -	Turns off LED 2 (green)
Exit	Exits monitor program

Appendix

For reference purposes, the back of the Wallace robot is considered the side with the reset and power switches.

Table A-1 : Required I/O connections

Motor Driver Board	Microcontroller Board
J2: Connected to left motor	
J3: Connected to right motor	
J4: EN1	MCU_PORT: PA4
J4: EN0	MCU_PORT: PA5
J4: D1	MCU_PORT: PA6
J4: D0	MCU_PORT: PA7

Infrared Receiver Board	Microcontroller Board
J2: Data	KEYPAD: PD2

Infrared Transmitter Board	Microcontroller Board
J2: Data	KEYPAD: PD3

Analog/Digital I/O Board	Microcontroller Board
J3: LED1	KEYPAD: PD4
J3: LED2	KEYPAD: PD5
J3: SW1	MCU_PORT: PE1
J3: SW2	MCU_PORT: PE2
J2: POT	MCU_PORT: PE4
J2: PHOTO	MCU_PORT: PE5
J2: BATVOLT	MCU_PORT: PE6

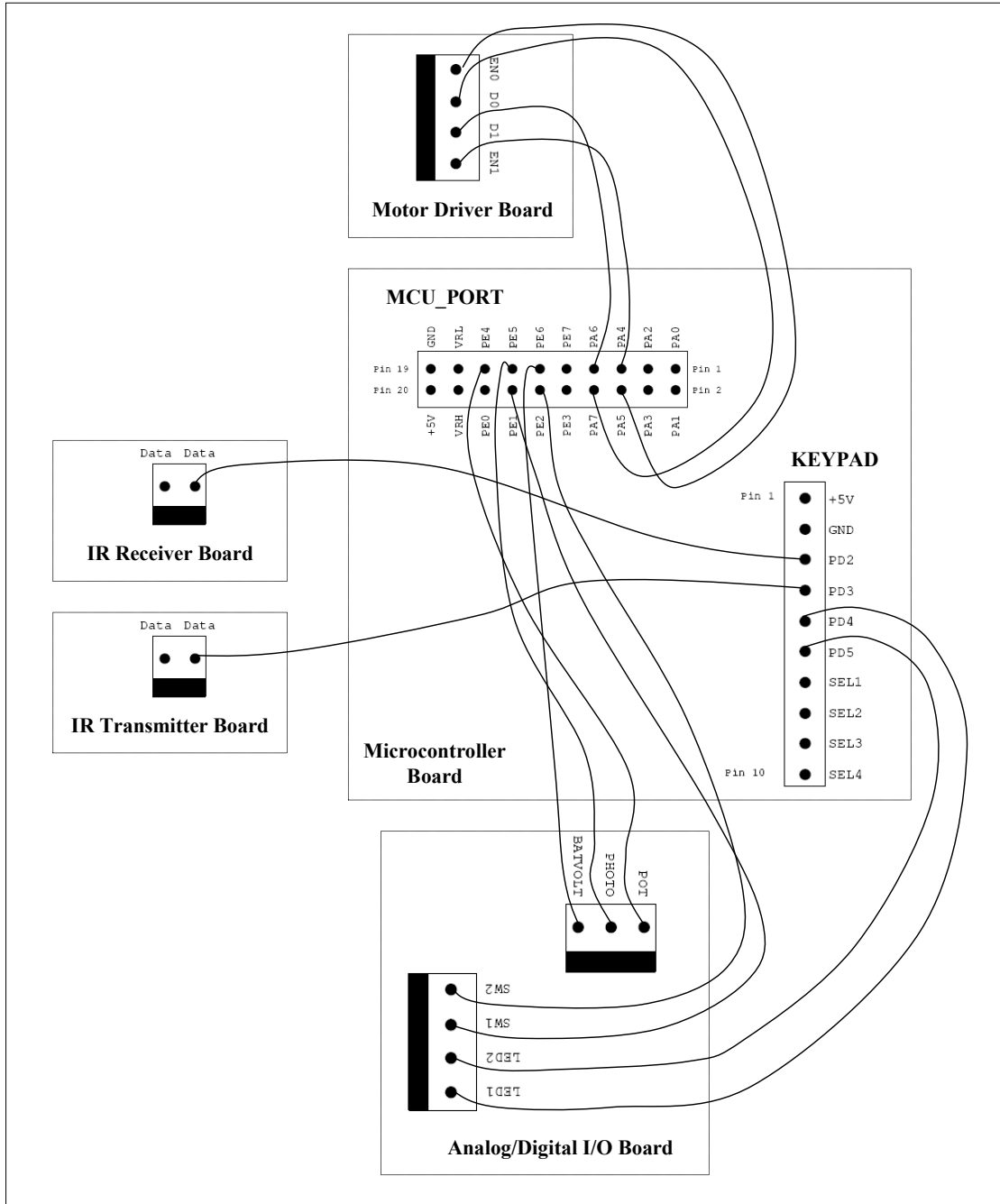


Figure A-1: Required I/O Wiring Diagram