A MONORAIL EMULATOR

USER MANUAL

SETTING UP YOUR MONORAIL

Connect each component to the appropriate port, as described in the table below.

COMPONENT	USAGE	PORT CONNECTION
LCD	Initially helps guide user to input number of stations, then names of stations, time travelled between stations and stopping time of monorail at any station. Following the LCD always displays the name of the next station.	**LCD Data Pins** D0-7 → PF0–7 **LCD Control Pins** BE → PA4 RW → PA5 E → PA6 RS → PA7
LED	2 LEDs blinks at a frequency of 3 Hz (3 blinks per second) when the monorail stops. 2 LEDs turned off when monorail travelling.	**2 LED Pins** LED0-2 → PC0-2
DC Motor	Spins at 60 revolutions per second when the monorail is travelling. When the monorail stops, the motor stops.	Mot → PE5 OpE → +5V OpO → TDX2
Buttons	PB0 simulates that a tourist (on the monorail) wants to get off the monorail at the next station. PB1 simulates that a tourist (on the next station) wants to get on the monorail.	PB0 → RDX4 PB1 → RDX3
Keypad	First # key simulates the monorail stopping halfway. Next # key simulates that the monorail continues to travel. Also simulate end of input through a special key "D".	C3–C0 → PL3–0 R3–R0 → PL7–4

Assembly

OPERATION INSTRUCTIONS

Parameters will be held by the target monorail system. Any input below the minimum will result in the parameter being set to the minimum and displaying this. Any input above the maximum will result in the parameter being set to the maximum and displaying this.

1. The number of stations. Minimum 2 (otherwise impractical) and Maximum 10.
2. The names of all stations. The station name will consist of a string of capital letters and white space, starting with a capital letter. Maximum number of characters for station name is 10.
3. The time for the monorail to travel from one station to the next station without stopping. The minimum time is 1 second (0 seconds is infeasible), and the maximum time is 10 seconds.
4. The stop time of the monorail of all stations. The minimum stop time is 2 seconds with maximum stop time at 5 seconds.

System Configurations will provide an interface to configure the target monorail system. A sample interface between the LCD and keypad will be displayed in the order below.

1. LCD output: "Type the max # of stations: ".
2. Keypad to take input in form of numbers 2-10 followed by special key "D". Any parameter number below the minimum or above the maximum will be configured as explained in Parameters. Any key besides a number input or the special key "D" (A, B, C,, *, #) will result in "Incorrect Input" being displayed on the LCD and the reset button to be pressed in order to try again.
3. LCD Output: "Name of Station 1..n: " where n is the number of stations inputted and 1..n signifies that the LCD output will the same output up to n.
4. Keypad to take input in the form of numbers 1-26 or "#" followed by special key "D". Any number from 1-26 followed by special key "D" will refer to an index in the alphabet as shown below. The "#" key will refer to a white space character being generated. Any key besides a number input, key "#" or the special key "D" (A, B, C,, *) will result in "Incorrect Input" being displayed on the LCD and the reset button to be pressed in order to try again. If the input is greater than 26 it will result In "Incorrect Input" being displayed in the LCD and the reset button to be pressed in order to try again. If a D is pressed without any input or 0 as an input, it will submit the input. Once the tenth character has been entered, the name will also submit.

A	B	C	D	E	F	G	H	I	J
1	2	3	4	5	6	7	8	9	10
K	L	M	N	O	P	Q	R	S	T
11	12	13	14	15	16	17	18	19	20
U	V	W	X	Y	Z				
21	22	23	24	25	26				

5. LCD Output: "Time from Station n to n+1 to 1 is: "
6. Keypad to take input in form of numbers 1-10 followed by special key "D". Any parameter number below the minimum or above the maximum will be configured as explained in Parameters. Any key besides a number input or the special key "D" (A, B, C,, *, #) or typing a 3 digit input will result in "Incorrect Input" being displayed on the LCD and the reset button to be pressed in order to try again.
7. LCD Output: "Stop time at any station is: "
8. Keypad to take input in form of numbers 2-5 followed by special key "D". Any parameter number below the minimum or above the maximum will be configured as explained in Parameters. Any key besides a number input or the special key "D" (A, B, C,, *, #) will result in "Incorrect Input" being displayed on the LCD and the reset button to be pressed in order to try again.
9. LCD Output: "Configuration is complete. Please wait…"
10. The system will then go through and display all entered information. After all the configuration data has been redisplayed the system will ask for confirmation. Pressing any input on the keypad will confirm. If any of the information has been entered wrong the reset button will need to be pressed to try again.

OPERATING MONORAIL AND INTERPRETING THE DISPLAYS

Emulation component starts after the system configuration is complete. This component will display the following operations and interpretations.

OPERATING

- **Button PB0** being pressed will indicate a tourist on the monorail wanting to get off at the next station. "Off" will be shown on the LCD.
- **Button PB1** being pressed will indicate a tourist wanting to get on at then next station. "On" will be shown on the LCD.
- **Keypad key "#"** to simulate the monorail stopping between two stations. Pressing "#" when the monorail is travelling between two stations will make the monorail stop immediately. Pressing "#" when the "#" has been pressed to stop the train between two stations will cause the monorail to continue to travel.

INTERPRETING

- **DC Motor** will emulate the monorail travelling and will run at speed of 60 RPS. If the monorail stops, the motor will stop. The RPS will be shown on the LCD.
- **2 LEDs** will blink 3 times per second (3 Hz) when the monorail is stopped and will be switched off when the monorail is travelling.
- **LCD** will always display the name of the next station for the first 10 characters on the first line. The characters 12-16 on the first line will display the measured RPS and target RPS. The second line will display up to 2 digits for the current passenger count in the first 2 characters. Characters 4-5 will signify 2 digits for tourists wanting to get on followed by characters 6-7 for the letters "O" and "N". Characters 9-10 for the 2 digits for passengers wanting to get off followed by 11-13 to show the letters "O", "F", "F". Finally, character 15 to show the seconds to the next station if the monorail is travelling to a station, or stopping seconds if the monorail is stopped at a station. In character 16 it shows "M" for monorail moving from one station to the other, "B" for monorail stopped between two stations, "S" for monorail stopped at a station.

EXAMPLE LCD DISPLAY

S	**T**	**A**	**T**	**I**	**O**	**N**	**.**	**.**	**.**		**M**	**RPS**		**T**	**RPS**
Tou	**Cnt**		**Tou**	**rist**	**O**	**N**		**Tou**	**rist**	**O**	**F**	**F**		**S**	**M/B/S**