

## MANUAL



**IOWA SCALED ENGINEERING – ELECTRONICS MADE EASY!** 

Thank you for purchasing the ProtoThrottle.

Our goal was to design and develop a wireless throttle that provides the diesel modeler with the most realistic experience operating their model locomotives.

The ProtoThrottle mimics a standard EMD control stand including full detent throttle and reverser handles, a spring-loaded horn handle, a push-on/push-off bell button, and fully programmable front and rear headlights with a setting for ditch lights. In addition, the ProtoThrottle comes with a robust faceplate machined from aluminum, including prototype bezels, and anodized to give the look and feel of a real control stand.

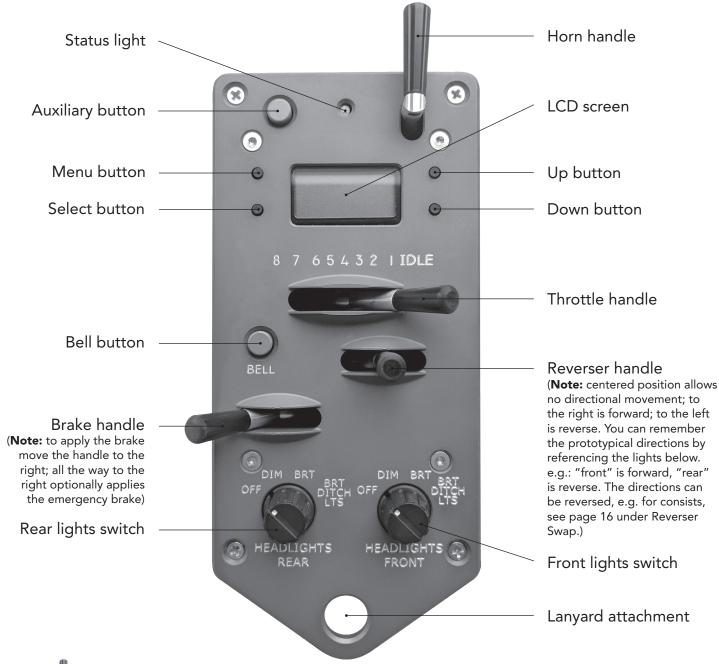
The ProtoThrottle comes with our commitment to your satisfaction. We warranty the throttle from manufacturing defects for one year, and if you should have any questions or issues with the ProtoThrottle, please contact us.

Scott Thornton Michael Petersen Nathan Holmes

# **Table of Contents**

ProtoThrottle Controls & Battery Install	4
Quick Start Guide	5
Main Screen	6
Engine Menu	7
Special Functions Menu	8
Load / Save Configuration Menus	9
Set Locomotive Menu	10
Force Function Menu	11
Configuration Function Menu	12
Notch Configuration Menu	14
Options Menu	15
System Menu	17
Communication Configuration Menu	18
Preferences Menu	19
Threshold Calibration Menu	21
Diagnostics Menu	22
Electronics Schematic	24
Licensing / Support	25
Open Source Development	26
Notes	27

## **ProtoThrottle Controls & Battery Install**



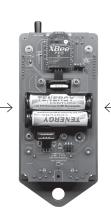


The ProtoThrottle is powered by 2 AA batteries (not included). The batteries can be alkaline or rechargeable NiMH.

.....

To access the battery holder, unscrew the 4 phillips head screws on the corners of the throttle's faceplate; remove the box; **IMPORTANT:** when removing the batteries from the holder, use one hand to hold **both** sides of the holder to prevent it from bending away from the printed circuit board; insert batteries and reattach the box. **Do not over tighten the screws.** 

**To conserve battery life:** make sure the throttle handle is in "idle" position and the reverser handle is in "centered" position when not in use. This will cause the throttle to go to sleep after 5 minutes. **To power down manually, see the instructions on page 6.** 



## **Quick Start Guide**

The ProtoThrottle will work with any scale and with sound- or non-sound decoders (though using sound enhances the control stand experience significantly). Any DCC decoder compatible with the NMRA standards will work with the ProtoThrottle because it uses standard DCC commands and functions via your command station.. The ProtoThrottle is not a DCC system and will not replace the system you use.

Check the Iowa Scaled Engineering website for the most current list of supported DCC command stations: <a href="https://www.iascaled.com">www.iascaled.com</a>

NOTE: if the ProtoThrottle is in "sleep" mode the LCD screen will be dark, click any of the LCD buttons to wake the throttle.



- 1. Configure your ProtoThrottle receiver using the instructions provided with the receiver.
- 2. Make sure the base address of the ProtoThrottle matches that of the receiver. (See page 18.)
- 3. If using multiple ProtoThrottles, set each throttle to a unique ID. (See page 18.)



Using your DCC system, **set acceleration momentum (CV3) mid-range to moderately high** so that the ProtoThrottle will need to "notch up" to get the train moving.

#### Set deceleration momentum (CV4) high or maximum.

This will allow the train to "coast" when the throttle is in the idle position requiring the use of the brake to slow or stop the train.

3

#### Input the locomotive number into the ProtoThrottle:



1. Click the Menu button 5 times



2. Click the Select button once



3. Use the Up and Down buttons to change numbers



4. Use the Menu button to move cursor right



5. After number is input, click Select button to save

SAVED!

**NOTE:** see page 10 for how to set a short (primary) address.

NOTE: the ProtoThrottle function settings are set to standard DCC function numbers by default. If you need to change any function number, the steps are explained below:

4

#### To check or set the horn, bell, and brake function numbers:



1. Click the Menu button 7 times



2. Click the Select button once

HORN FØ7 3. Click the Up or Down button to change the function number

BRAKE F10 4. Click Menu button to toggle through the other function choices. Repeat step 3 to change additional function numbers.

SAVED!

5. Click the Select button to save all changes

5

#### Enjoy operating your locomotive!

Please read the entire manual to familiarize yourself with all the features of the ProtoThrottle. See our website for more specific instructions on programming.

In addition, our website has detailed operational scenarios developed by professional locomotive engineer, Tim Garland. If you are not familiar with prototype operation from a engineer's perspective, Tim's scenarios will give you insight on how to operate more realistically using the ProtoThrottle.

## ELEMENT DESCRIPTION

0250 |

Locomotive Address. Long (extended) addresses are displayed directly (e.g. 0250 0000 9999). Short (primary) addresses are displayed with an 's' prefix (e.g. 5003 5000 5127).

In certain situations the locomotive address may be replaced by an alert message:

**EMRG** Emergency stop is active!

Note: move the brake handle all the way left to deactivate.

REU! Reverser was moved with the throttle not in idle

12:00A

O

The ProtoThrottle acts as a secondary display for Iowa Scaled Engineering's wireless fast clocks <a href="https://www.iascaled.com/store/MRBW-FCM">www.iascaled.com/store/MRBW-FCM</a> or the fast time provided by the NCE Cab Bus.

<sup>★</sup> 12-hour mode AM indicator F 12-hour mode PM indicator

No AM or PM indicator when in 24-hour mode.

Battery Status: Batteries good Batteries low Batteries batteries

Display will show LOW BATTERY when the batteries are critically low. Operation will not be possible until the batteries are replaced.

When "AX" is on screen the auxiliary button is active

Up/Down Button Status. On the main screen, the Up and Down buttons can be assigned to functions. The on/off status of those assigned functions are displayed on the LCD screen.

- Function off
- Function on

**Note:** pressing and holding the Menu button (upper left LCD button) momentarily will return you to the main screen from any of the main menus.



Click "down button" to turn off throttle

Advance to Engine Menu

Toggle backlight on/off; **hold** to power down throttle

LCD Screen

Down

NOTE: these buttons can be assigned a function using the Configure Function menu

# ENGINE OFF

#### **DESCRIPTION**

The behavior of the Engine menu depends on the configuration of the ENG ON and ENG STOP settings in the Configure Function menu. For DCC decoders that take a single function on/off to turn the prime mover on/off (such as ESU Loksound or TCS WOWSound decoders), configure ENG ON to that function number and set ENG STOP to off (F——). The Engine menu will then change between OFF and ON when pressing the Up and Down buttons.

ENGINE OFF

ENGINE ON

If a decoder is edge triggered instead (requires a function on/off transition) to turn the prime mover on and off (such as Soundtraxx Tsunami2), set both ENG ON and ENG STOP to the appropriate function numbers. In this case, the Engine menu will display STARTING and STOPPING between the ON and OFF settings as the assigned functions are sent to the locomotive decoder.

ENGINE OFF ENGINE STARTING

ENGINE ON ENGINE STOPPING ENGINE OFF

If the throttle is not in idle when attempting to turn off the prime mover, a warning will be displayed and the ENG STOP function will not be sent. Move the throttle back to idle to continue.

ENGINE NOT IDLE

Example #1, F8 for ESU Loksound or F12 for TCS WOWSound:

ENG ON = F08 ENG ON = F12 ENG STOP = F-- ENG STOP = F--

Example #2, F5 (on, RPM+) and F6 (off, RPM-) for Soundtraxx Tsunami 2:

ENG ON = F05 ENG STOP = F06

Advance to Tonnage Menu

**LCD Screen** 

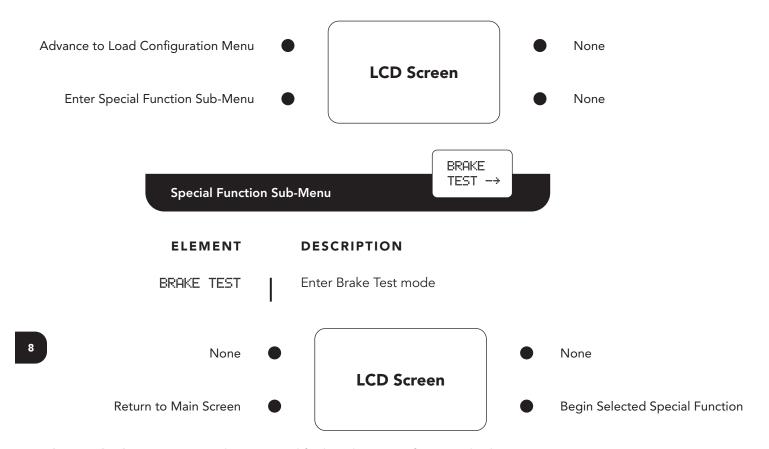
Start or turn on prime mover

Stop or turn off prime mover

Return to Main Screen

## **Special Functions Menu**





#### What is a brake test? (Note: this is a simplified explanation of train air brakes)

After an engine couples up to a string of cars and the air hoses are connected, the engineer and conductor will usually perform a brake test to ensure there are no air leaks, the pressure drop reaches the end of the train, and the air pressure through the brake lines is adequate. Each car in the train has a reserve air tank that is pressurized to apply the brakes. When the air pressure through the train line is approximately 90 psi, a value on each car closes off the reserve air tank thus keeping the car free rolling. When the train line air pressure is **reduced** it causes the valve in each car to open releasing the pressurized air from the reserve tank thus applying the brakes. This process is called a "failsafe" because if the train loses it's train line pressure the train will automatically brake. A brake test is performed when the engineer reduces the train line pressure by approximately 20-26 psi thus applying the brakes and the conductor visually confirms the brakes being applied. To simulate this test with the ProtoThrottle, follow the steps below (**note:** the time is user-variable):

- **1.** Release the brake handle and watch the pressure build to it's maximum of approximately ~89-91 psi (air is simulated increasing into the train line; compressor sound is playing).
- **2.** Perform the brake test by moving the brake handle to the right. A 26 psi reduction will show on the gauge. (air is simulated reduced through the train line; air letoff sound plays).
- **3.** Release the brake handle and let the pressure return to the maximum (*compressor sound starts; once ~90 psi is reached the compressor will silence*).
- **4.** Press the "Return to Main Screen" key to return the throttle to normal operation and the train can now be moved.

## **Load / Save Configuration Menus**

LOAD CNF 01: 0250

SAVE CNF 01: 0250

LOAD CNF: Advance to SAVE CNF SAVE CNF: Advance to Set Locomotive Menu

> Load selected configuration (and return to Main Screen) or Save current configuration (and return to Main Screen)

•

**LCD Screen** 

- Increase configuration number
- Decrease configuration number

LOAD CNF 01: 0250 SAVE CNF 01: 0250

Load / Save Configuration Sub-Menu

#### **ELEMENT**

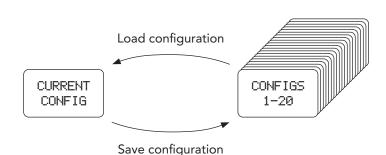
#### **DESCRIPTION**

LOAD CNF 01: 0250 ©1: Configuration Number. Up to 20 distinct configurations (locomotive address, function mappings, throttle notch settings, options) can be stored in the ProtoThrottle and loaded quickly using this menu.
©25© Locomotive Address. This is the locomotive address associated with the selected configuration number.

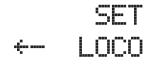
SAVE CNF 01: 0250 Save Configuration screen saves the **current loaded configuration** (with any changes you've made) into whatever configuration slot is on the screen. In order to copy an established configuration, you must load it into the throttle first before "saving" it to another slot.

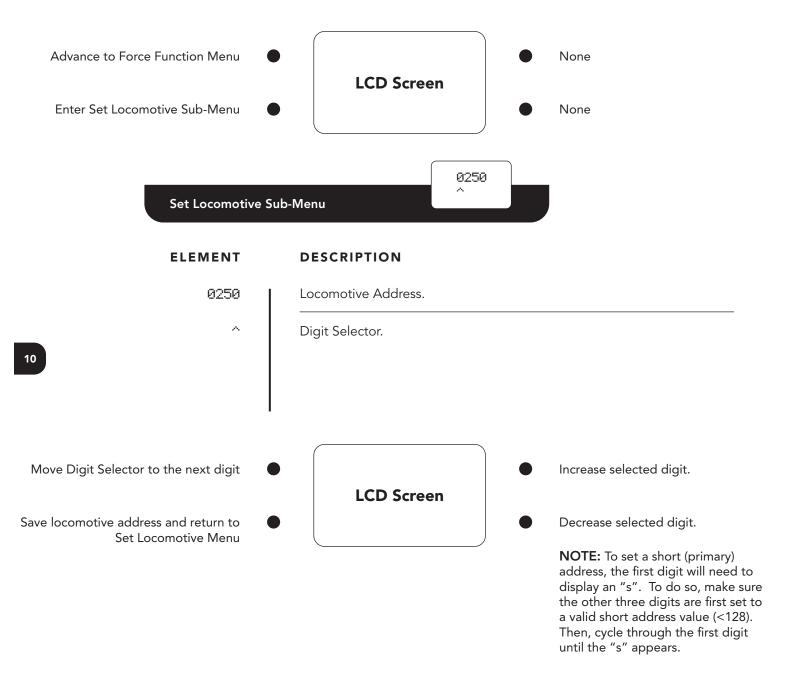
CONFIRM LOAD? → Both the Load Configuration and Save Configuration functions will ask you to confirm before executing by pressing the Down button. To cancel, click the Menu button.

CONFIRM SAVE? →



## **Set Locomotive Menu**





## **Force Function Menu**



Advance to Configure Function Menu

LCD Screen

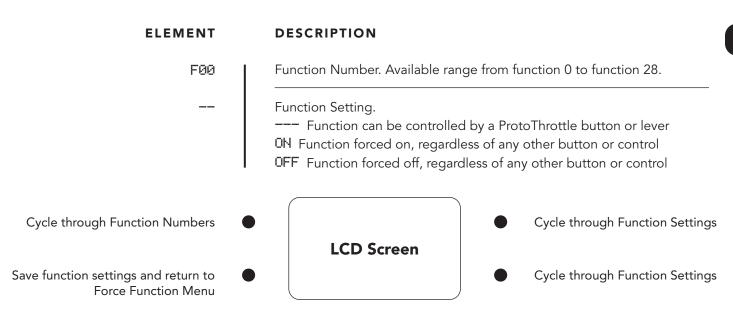
Enter Force Function Sub-Menu

None

Force Function Sub-Menu

**NOTE:** The Force Function menu allows any of the 29 standard DCC functions to be turned ON or OFF, regardless of any other ProtoThrottle lever or button. These can be used to test functions or control additional features of the decoder such as auxiliary, class, or lesser used lights.

F00 --



**NOTE:** In the Force Function menu, the horn lever does not activate the horn function. Instead, it will activate the currently selected function number if the function setting is ---.

# **Configure Function Menu**



Advance to Notch Configuration Menu

LCD Screen

Enter Configure Function Sub-Menu

Down

Configure Function Sub-Menu

Configure Function Sub-Menu

#### **ELEMENT**

#### **DESCRIPTION**

HORN

Control Name. The name of the ProtoThrottle button or handle to which a function can be assigned.

HORN Horn lever

**BELL** Bell button

BRAKE Brake lever, when brake is activated

BRK OFF Brake lever, when in the full left position

**AUX** Aux button

ENG ON Prime mover ON/start function (see Engine menu for details)

**ENG** STOP Prime mover stop function (see Engine menu for details)

THR UNLK Function which, when active due to another control, allows the throttle to send speed commands when the reverser is in centered position. (e.g. Loksound Drive Hold)

REV SWAP Function which, when active due to another control, flips the direction of the reverser

**CENTERED** Reverser center position

ALERTER Function activated when the alerter timer is about to expire

COMPRSR Compressor sound for the brake test mode

BKR TEST Brake test (air release sound)

F. HEAD Front headlight; active in the Bright and Ditch Lights settings

F.DITCH Front ditch lights; active in the Ditch Lights setting

F.DIM #1 Front dim headlight function #1; active in the Dim setting

F.DIM #2 Front dim headlight function #2; active in the Dim setting

R. HEAD Rear headlight; active in the Bright and Ditch Lights settings

R.DITCH Rear ditch lights; active in the Ditch Lights setting

R.DIM #1 Rear dim headlight function #1; active in the Dim setting

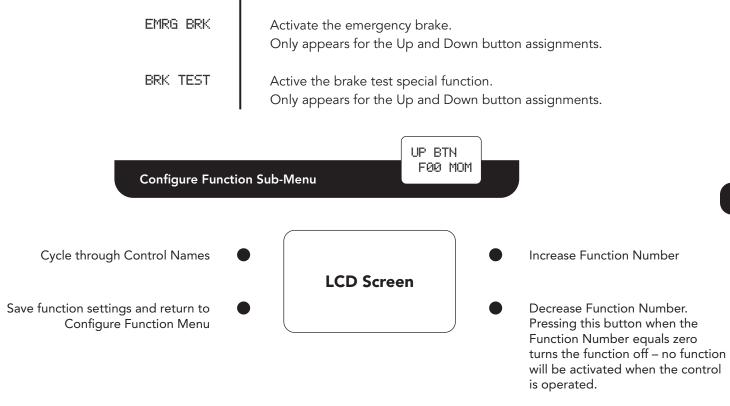
R.DIM #2 Rear dim headlight function #2; active in the Dim setting

Continued on next page

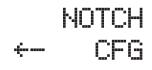
#### 12

#### Continued from previous page

UP BTN Main screen Up button DOWN BTN Main screen Down button F00 Function Number. The function to be activated when the associated ProtoThrottle button is pressed or control is moved. Available settings are none (F--) and functions 0 (F $\overline{99}$ ) to 28 (F $\overline{28}$ ). MOM Momentary / Latching Function. Only appears for the Up and Down button assignments. MOM Momentary – the function is only active while the button is pressed LAT Latching – the function toggles on and off with each press of the button EMRG BRK Activate the emergency brake. Only appears for the Up and Down button assignments. BRK TEST Active the brake test special function. Only appears for the Up and Down button assignments.



# Notch Configuration Menu



Advance to Options Menu None **LCD Screen** Enter Notch Configuration Sub-Menu None NOTCH #

Notch Configuration Sub-Menu

#### **ELEMENT DESCRIPTION**

Notch Number.

Speed Step. The speed step to send when the throttle is in the selected 102 Notch Number. Range from 1 to 126 (128 speed step mode only). Idle is

102

always speed step zero.

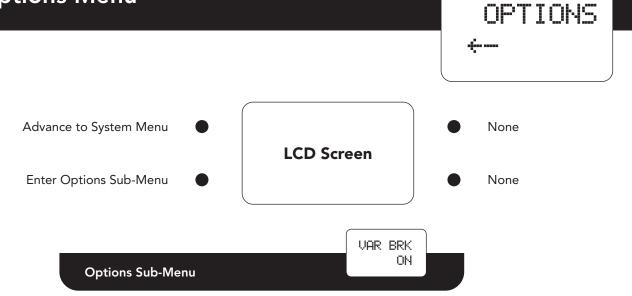
Cycle through Notch Numbers

Save notch settings and return to Notch Configuration Menu **LCD Screen** 

Increase Speed Step

Decrease Speed Step

## **Options Menu**



#### **ELEMENT**

#### **DESCRIPTION**

VAR BRK OFF

BRK TYPE

**PULSE** 

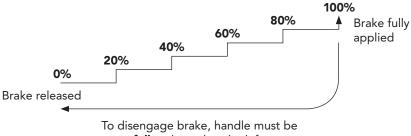
NOTE: Only displayed if variable brake is **ON**  Variable Brake. When set to ON, the brake effect will be proportional to the brake handle position. It is recommended to disable the emergency brake when variable braking is enabled. When set to OFF, the brake will be a simple on/off function.

Brake type:

- PULSE braking
- STEP braking (works with TCS WOWSound function)

Pulse braking. The brake function will be pulsed at a duty cycle corresponding to the brake handle position, simulating varying amounts of braking force.

**Step braking.** This feature is for use with TCS WOWSound decoders only. As the brake handle is moved to the right, a greater percentage of the brake is applied.



fully released to the left.

NOTE: the only way to disengage the brake is to fully release the brake handle completely to the left. Also, the emergency brake feature must be disabled for step braking to work correctly.

Continued on next page

#### **ELEMENT**

#### **DESCRIPTION**

BRK RATE 0.5s

NOTE: Only displayed if variable brake is ON and brake type is PULSE

BRK ESTP ON

REV SWAP OFF Brake Pulse Rate

This sets the rate (0.2-1.0 second) at which brake commands are sent during pulse braking. A smaller value results in smoother braking but can result in a less responsive DCC system due to more commands being

sent on the throttle bus.

**E-Stop on Brake Handle.** When set to ON, the brake handle can set emergency stop for the selected locomotive when moved completely to the right. When set to OFF, the brake handle will not cause an

emergency stop to be set.

**Reverser Swap.** When set to ON, the reverser directions are swapped. This can be used to correct for a locomotive whose direction is set incorrectly or when changing the leading end of a back-to-back consist.

When set to OFF, the reverser directions are normal.

Cycle through Options

LCD Screen

Increase or set option value

Decrease or set option value

. .

Save setting and return to Options Menu

## System Menu





Advance to Communication Configuration Menu

Configuration Menu

Enter System Sub-Menu

LCD Screen

None

None

MENU LCK

### Options Sub-Menu

#### ELEMENT

#### **DESCRIPTION**

MENU LCK OFF When set to ON, only the following menus are available: ENGINE, TONNAGE, LOAD CNF, SET LOCO, FORCE FUNC, and SYSTEM.

ON

ADV FUNC OFF When set to ON, advanced functions in the throttle are enabled. These include the Threshold Calibration menu and the Transmit Interval and Transmit Holdoff settings in the Preferences menu.

BAT OKAY 2.2V **Battery OK Voltage.** The voltage above which the batteries are considered good. ■

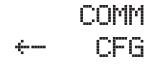
BAT WARN 2.0V **Battery Warning Voltage.** The batteries are low when the voltage is between the OK and Warning levels. □

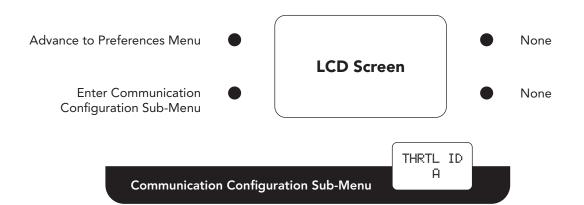
BAT CRIT

The batteries need to be replaced when the voltage is between the Warning and Critical levels.  $\Box$ 

**NOTE:** When the voltage falls below the Critical level, LOW BATTERY will be displayed and operation of the throttle will not be possible.

# **Communication Configuration Menu**





#### **ELEMENT**

#### DESCRIPTION

THRTL ID

BASE ADR 00

TIME ADR BASE

TX INTUL 1s

TX HLDOF 0.15s **Throttle ID.** Set each throttle to a unique ID using letters A-Z

**Base Address.** Set to the address of the ProtoThrottle receiver – see reciever instructions.

**Time Source Address.** Selects the fast time source. Set to "BASE" to display time information received from the command station by the ProtoThrottle receiver. To use an Iowa Scaled Engineering Wireless Fast Clock Master, set to the Node Address of the clock (0x01 to 0xFE). Set to "ALL" to display any time information received by the ProtoThrottle. The "ALL" setting works well with a single receiver in a private setting, but may result in erratic time display when multiple ProtoThrottle receivers are in close proximity (e.g. a public train show).

**Transmit Interval.** Time between periodic wireless transmissions to the ProtoThrottle receiver. This setting can only be changed if Advanced Functions are ON in the SYSTEM menu.

**Transmit Holdoff.** Minimum time between wireless transmissions to the ProtoThrottle receiver. This setting can only be changed if Advanced Functions are ON in the SYSTEM menu.

Cycle through Address/ID Names

Save Address/ID settings and return to Communication Configuration Menu

LCD Screen

Increase

Decrease

LCD Screen

None

Enter Preferences Sub-Menu

LOD Sciecti

None

#### **Preferences Sub-Menu**

#### **ELEMENT**

#### **DESCRIPTION**

SLEEP DLY: 5M **Sleep Delay.** Time until the throttle automatically enters low power mode. The throttle handle must be in idle, the reverser handle in centered position, and no buttons or controls actuated for this time. Range from 1 to 99 minutes.

ALERTER DLY: 60s Alerter Delay. Maximum time allowed without moving any controls. Ten seconds prior to this time, the LCD screen will flash and display ALRT. The Alerter function will also be activated. To cancel the alerter, move and lever or push any button. If the time expires without any lever being moved or button pressed, the speed will be set to zero and the brake function activated. To then reset the alerter, place the throttle in idle and center the reverser.

TIMEOUT CLK: 10s **Clock Timeout.** Maximum time between fast clock time packets. If no time information is received in this interval, the clock display will show dashes to indicate it has lost communication with the fast clock master. Range from 1 to 25 seconds.

PUMP RATE: 4 **Pump Rate.** Pumping rate in the brake test special function. Total pumping time can be varied from ~8 seconds to 2 minute 45 seconds. A setting of 4 is approximately 35 seconds.

LED BLNK ON **LED Blink.** When set to ON, the LED on the ProtoThrottle will blink green when communication with a ProtoThrottle receiver is active. When set to OFF, the LED will remain off when communication is active. The LED will always blink red when no communication link has been established.

Continued on next page

19

#### **ELEMENT**

#### **DESCRIPTION**

REV LOCK ON **Reverser Lock.** When set to ON, the reverser can only change the locomotive direction when then throttle is in idle, just like the prototype (in fact, on the prototype, the reverser handle is locked and cannot be moved). If the reverser is moved when the throttle is not in idle, the direction will remain the same and the Main Screen will display REU!. When set to OFF, the reverser is allowed to change the locomotive direction regardless of the throttle setting.

STRICT SLP OFF **Strict Sleep.** When ON, the reverser must be centered for the throttle to automatically go to sleep. When set to OFF, the reverser position does not matter and the throttle will go to sleep with the reverser in any position.

Cycle through preference settings

LCD Screen

Increase value or turn on setting

Save preference settings and return to Preferences Menu

Decrease value or turn off setting

20

Advance to Diagnostics Menu

**LCD Screen** 

None

Enter Threshold Calibration Sub-Menu

None

**NOTE:** These settings are factory calibrated and do not, under most circumstances, need to be changed.

NOTE: Only displayed if Advanced Functions are ON in the SYSTEM menu

HORN O

240

Threshold Calibration Sub-Menu

Modify them at your own risk!

#### **ELEMENT DESCRIPTION**

NAME

Control Name. The name of the ProtoThrottle control to be calibrated. Hold the control in the desired location and press the Up button to set the new calibration value.

**HORN** Threshold for the horn function activation

BRAKE Threshold for the brake function activation

BRAKE LOW Left brake handle stop

BRAKE HIGH Right brake handle stop; also threshold for emergency stop

O

Control Status. Shows the on/off status of the selected control.

- o OFF
- ON.

240

Internal ADC value for the selected control. Can normally be ignored, unless you're developing code for the ProtoThrottle or are just a nerd.

Cycle through Control Names

**LCD Screen** 

Set new calibration value

Save threshold settings and return to Threshold Calibration Menu

None

Enter Diagnostics Sub-Menu

LCD Screen

None

None

Diagnostics Sub-Menu

#### **ELEMENT**

#### **DESCRIPTION**

0 0% I N - 0 - **Controls Display.** Shows the current status of the ProtoThrottle controls and buttons. Pressing the up/down buttons will toggle through the current DCC function status.

SLEEP 300 sec **Sleep Timeout.** Shows the number of seconds until the throttle goes to sleep.

ALERTER OFF **Alerter.** Shows the number of seconds until the alerter expires.

ENGINE HISTORY **Engine History.** Use the up/down buttons to scroll through the engine state history stored in the throttle. The last eight engine on/off states are automatically stored, and recalled, when changing configurations or locomotive address.

PKT TIME

**Packet Timeout.** Timer reset by each packet received from the ProtoThrottle receiver. Communication is considered lost when the bar reaches zero.

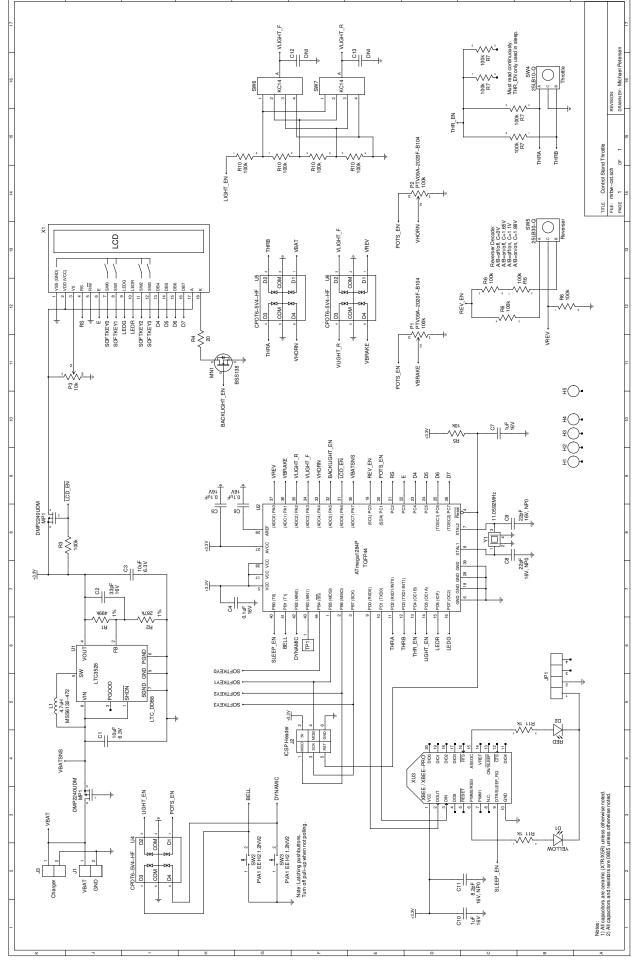
RSSI -43dBm **Received Signal Strength Indicator.** Reports the strength of the wireless connection to the throttle.

FT RATIO 2.4:1 **Fast Time Ratio.** Reports the fast time ratio from the last update received.

Continued on next page

## **ELEMENT DESCRIPTION Battery Voltage** BATTERY 2.300 **ProtoThrottle Firmware Version** VERSION 1.1.0 **ProtoThrottle Firmware Short Git Hash** GIT REV 000000 Base Type. The type of ProtoThrottle receiver to which the ProtoThrottle BASE TYP is connected. CAB BUS **Base Unit Short Git Hash** BASE REV 000000 Factory Reset. Press the Down button 5 times to reset the FACTORY ProtoThrottle to factory settings. WARNING: This will erase all RESET 5→ configuration settings, except those in the Threshold Calibration menu, so use with caution! Cycle through diagnostics settings None **LCD Screen** Return to Diagnostics Menu None





#### **Open Design**

lowa Scaled Engineering is committed to creating open designs that users are free to build, modify, adapt, improve, and share with others.

#### **Hardware**

The design of the ProtoThrottle hardware is open source hardware, and is made available under the terms of the Creative Commons Attribution-Share Alike v3.0 license, a copy of which is available from: <a href="http://creativecommons.org/licenses/by-sa/3.0/">http://creativecommons.org/licenses/by-sa/3.0/</a>

Design files can be found on the Iowa Scaled Engineering's Github site: <a href="https://github.com/lowaScaledEngineering/mrbw-cst">https://github.com/lowaScaledEngineering/mrbw-cst</a>

#### **Firmware**

The official Iowa Scaled Engineering firmware for the ProtoThrottle is free software: you can redistribute it and/or modify it under the terms of the GNU General Public License as published by the Free Software Foundation, either version 3 of the License, or (at your option) any later version. A copy of the GNU GPL can be found at: <a href="http://www.gnu.org/licenses/gpl.html">http://www.gnu.org/licenses/gpl.html</a>

New firmware can be flashed into the ProtoThrottle through J2. The six pins are a standard AVR 6-pin ISCP programmer connection.

We encourage you to join the ProtoThrottle group forum:

## https://groups.io/g/ProtoThrottle

The forum will help with general and technical questions regarding the ProtoThrottle.

# Visit the Iowa Scaled Engineering website to learn more about our full line of model railroad electronics.

www.iascaled.com

support@iascaled.com

© 2021 Iowa Scaled Engineering, LLC and Designgrid, LLC

Manual Version 1.2

## ProtoThrottle Model: MRBW-CST, HW Version: 1.2

lowa Scaled Engineering, LLC support@iascaled.com

This product is not a toy. For ages 14 and over.

#### Contains FCC ID: MCQ-XBEE3

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Changes or modification to the device could void the user's authority to operate the equipment.

#### Contains Model XBEE3, IC: 1846A-XBEE3

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

- (1) This device may not cause interference; and
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes:

(1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Changes or modification to the device could void the user's authority to operate the equipment. Des changements ou des modifications à l'appareil pourraient annuler l'autorité de l'utilisateur à utiliser l'équipement.

# Notes

2-





**IOWA SCALED ENGINEERING - ELECTRONICS MADE EASY!** 

www.protothrottle.com