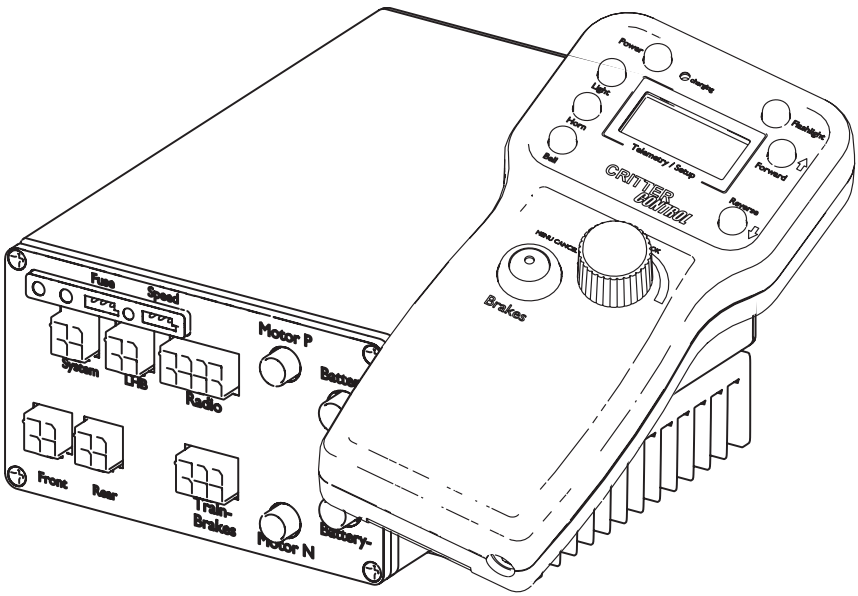
Critter Control
Model CC 50 A



User Manual

INTEGRAL CIRCUITS

Notice:
This Manual is no longer up to date. All mentioned functions are still the same in the new hardware version, however there have been additions and some bug fixed been made that are not reflected yet. There will be an update of this manual after the next hardware turnaround.

Table of Contents

1. Introduction 5
What's in the box? 5
1a. THE CC50A HANDSET 6
2. Handset - Before first use 7
Inserting the rechargeable batteries into the handset. 7
Charging the handset batteries 7
Charger LED indicator codes: 8
Turning the handset on. 8
Turning the handset off. 8
3. System startup procedure 9
Startup: 9
4. System and Error Messages 10
User Induced E-STOP: 10
5. Control of your locomotive 11
Setting speed: 11
Changing direction: 11
Applying brakes: (With brake controller) 12
Stopping/slow down:(Without brake controller) 12
Locking brakes: (With brake controller) 13
Unlocking brakes: (With brake controller) 13
Checking locomotive battery voltages 13
Turning on the lights 14
Sounding the horn 14
Turning the bell on and off 14
6. Setup Menu 15
Entering the Setup Menu: 15
Changing menu settings. 16
Description of functions: 17
7. The CC50A (hardware setup) 18
Connections of the CC50A 18
Installing the radio Tranceiver 19
Installing the system connector 20
Installing the accessory connector 21
Horn installation variants 22
Installing the brake connector 23
Brake controller installation diagram (BC100) 24
Brake controller installation diagram (BC50) 24
Combo controller installation diagram (BHC100) 25
Installing the speed sensor 26
9. Wiring Diagram 28

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The CC50A utilizes a matched pair of radios . the following two labels are the addresses and serial numbers of the locomotive unit and handset

Locomotive MAC Address and S/N

If there is no label here , the same label/ information can be also found on the radio tranceiver and the mounting side of the Locomotive unit.

Handset MAC Address and S/N

If there is no label here, the same information can be found on the back of the handset.

FC

XBee™

2.4 GHZ

Contains FCC ID: MCQ-PROS2B
The enclosed device complies with Part 15 of the FCC Rules. Operation is subject to the following conditions:

(i.) this device may not cause harmful interference and
(ii.) this device must accept any interference received, including interference that may cause undesired operation.

WARNING

Radio Transmitting Device

This handset contains a low power “spread spectrum” radio transmitter. While the effective radiation of this device is less than 200mW and though care has been taken to design this handset such that the location of the antenna minimizes human exposure to its 2.4GHz energy, care should be taken to hold the handset per design to limit futher exposure and to improve operational performance.

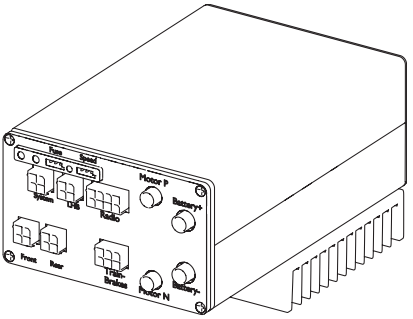
1. Introduction

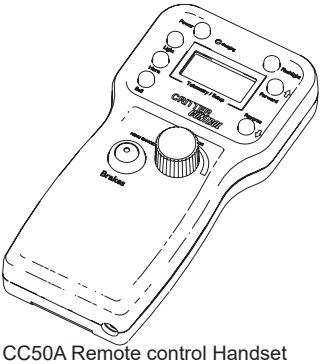
What's in the box?

Make sure your box contains everything listed below. If any pieces are missing, contact the seller.

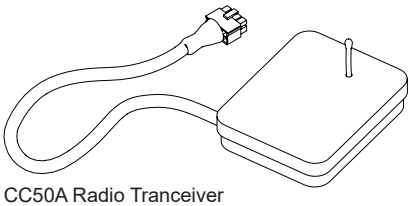
If this system got delivered pre-built into a locomotive, make sure that these items are listed by your seller and nothing is missing.

CC50A Locomotive control unit

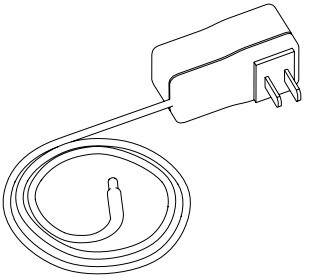




CC50A Remote control Handset



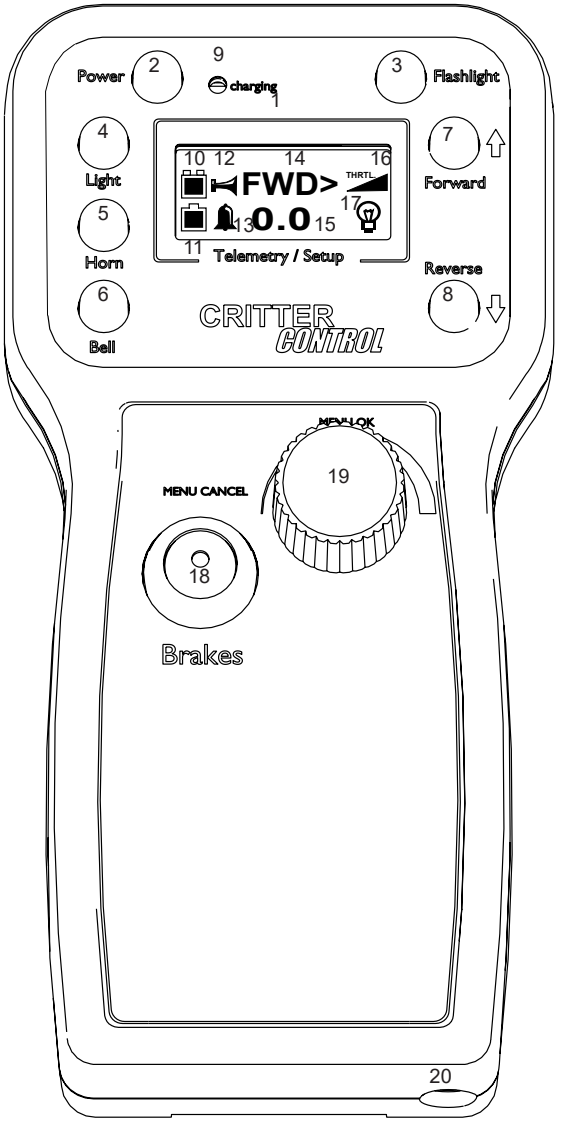
CC50A Radio Tranceiver



12V Charger for CC50A Handset

Package of connectors
(pre-made connectors with specified wirelengths can be purchased separately)

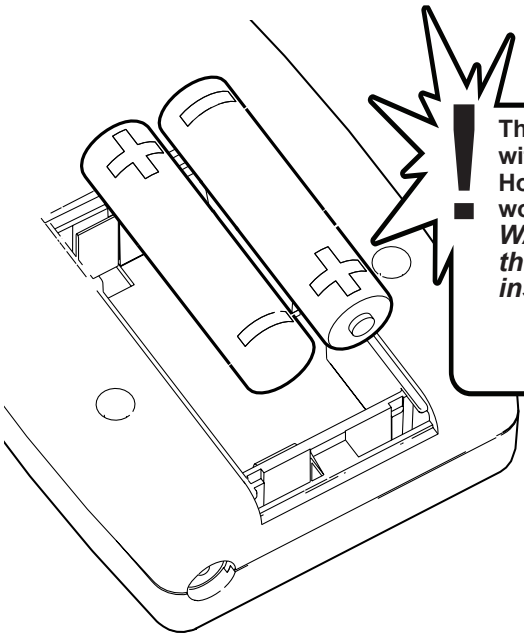
1a. THE CC50A HANDSET



1. Main Display
2. Power Button
3. Flashlight button
4. Lights button
5. Horn button
6. Bell button
7. Forward button
8. Reverse button
9. Charging indicator
10. Locomotive Battery Indicator
11. Remote Battery Indicator
12. Horn indicator
13. Bell indicator
14. Direction indicator
15. Throttle/PSU/Speed
16. Throttle indicator
17. Lamp indicator
18. Brake button
19. Control Knob
20. Charging port

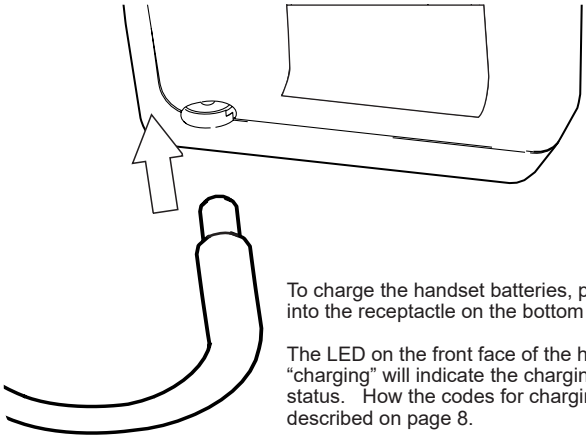
2. Handset - Before first

Inserting rechargeable batteries into the handset.
(NiMH with at least 2000mAH are recommended)



The handset can also be operated with 2 regular AA Alkaline batteries. However, the internal charger will only work with rechargeable batteries.
WARNING: Do not attempt to use the charger with alkaline batteries installed!

Charging the handset batteries (with Rechargeable batteries inserted)



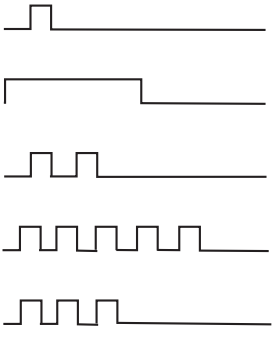
12V charger plug

To charge the handset batteries, plug the charger into the receptactle on the bottom of the handset.

The LED on the front face of the handset marked “charging” will indicate the charging mode and status. How the codes for charging are read is described on page 8.

Charger LED indicator codes:

Code:



Pre charge state - 1 short flash per second

Rapid Charge - led is equally on/off per sec

Post charge - led flashes short twice

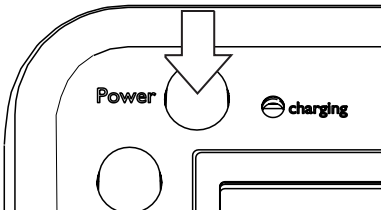
No battery detected - 5 short pulses

Post charge constant voltage mode - 3 short flashes

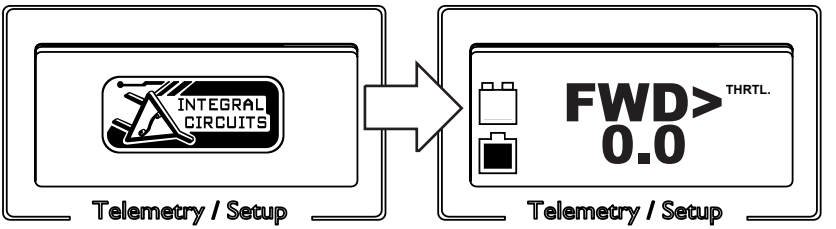
During charging, if the battery is deeply discharged, the charger will indicate it is in a "pre-charge" state in which the battery voltage is brought up to approximately .8V per cell before commencing rapid charge.
If the batterys are at .8V per cell or above, the charger will enter rapid charge mode in which the batteries are charged at 500mA for a maximum time of 5 hours

Please note: The charger will not start rapid charging the batteries if they are still more than 50% charged.

Turning the handset on.



Press and hold the power button for 2 seconds. You will see the splash-screen before the handset shows the main dashboard. The handset is now ready to use



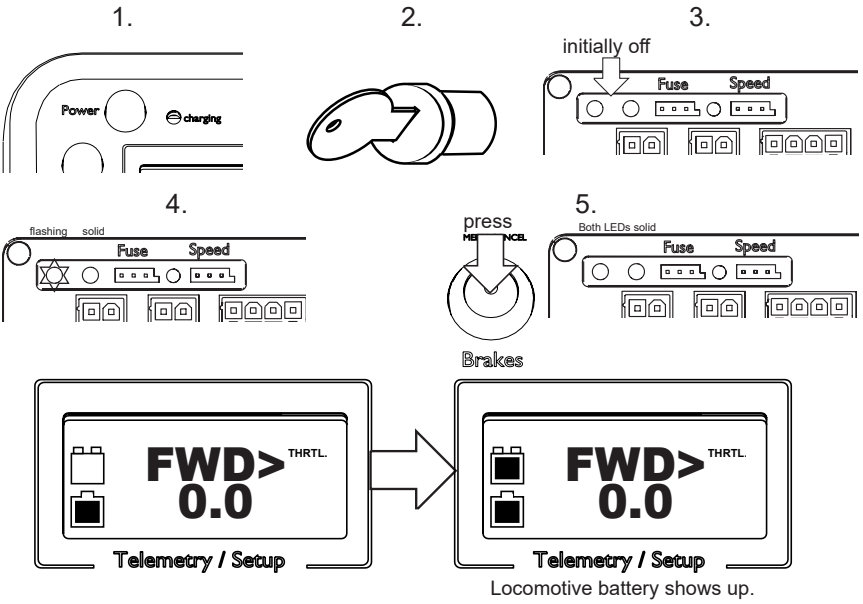
Turning the handset off.

To turn the handset off you have to press and hold the power button for another 2 - 3 seconds until it shows "info shutdown"

3. System startup procedure

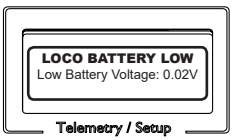
Startup:

1. Turn on the handset by pressing the power button for 2 seconds
2. Turn the Key switch on your locomotive to ON. Position.
3. The CC 50A will go through a startup sequence.
4. When all system checks are done and turn out OK, it will start flashing the system LED indicator while the Master Relay led will become lit solid
5. press the brake button on the handset until the system LED lights up solid .



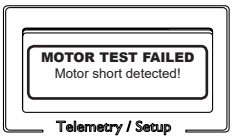
Locomotive battery shows up.

Startup Error Messages:
These error messages appear if any of the system checks at startup return a negative result.
The controller will check for battery voltage and motor drive/motor health, before it unlocks the system for use



Low locomotive battery error:

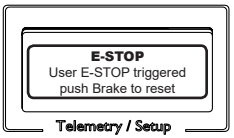
Symptom:	Solution:
Battery voltage shows 0	Check the wire and fuse for battery monitor 2
Battery voltage is ~ 18.0V	Locomotive batteries need recharged.



Motor test failed error:

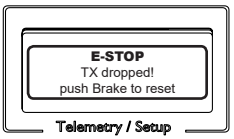
Symptom:	Solution:
Motor short detected!	Check the wiring of the motors for shorts. Check the motors directly for shorts.

4. System and Error Messages

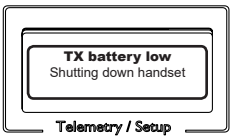


User E-STOP:
This message shows when the power button is pressed while the system is in operation.
It indicates that the locomotive entered the emergency stop state.

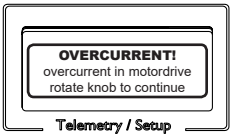
This can be cancelled with a push of the brake button.



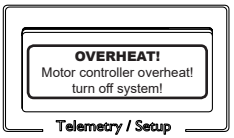
Dropped handset E-STOP:
This message shows whenever the handset is dropped and been in freefall for
longer than the period specified in the setup menu. (“fall time” page 17.)



Handset battery low warning:
This message shows whenever the batteries of the handset fall below a charge voltage of 1.9v . This message is only shown for a short moment before the handset turns itself off. (safety shutdown)
Immediate recharging of the Handset batteries is adviced.



Overcurrent Warning:
The system triggers this message whenever the internal current limit of approximately 75A is overstepped. This is a safety feature to prevent damages to the motor or motor drive due to mechanical blockage or overburdening of the locomotive.
Please note that the locomotive wont stop when this occurs, but the internal safety will turn off the drive on a per PWM cycle basis, and limiting the current.
To dismiss this message you need to rotate the knob of the handset a notch backwards.

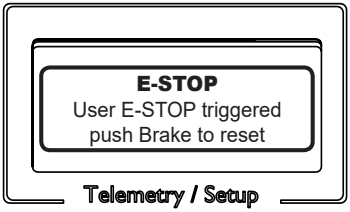


Overheat E-STOP:
The system triggers an Cycle STOP whenever the internal temperature sensors measure a tamperature above the safe zone for the internal components.

This message can not be dismissed until the locomotive and handset have been power cycled
System cool down before further use is adviced!

User Induced E-STOP:

If you press the power button at any given time the locomotive will go into an User requested E-Stop. To cancel this you need to push the brake - button once.

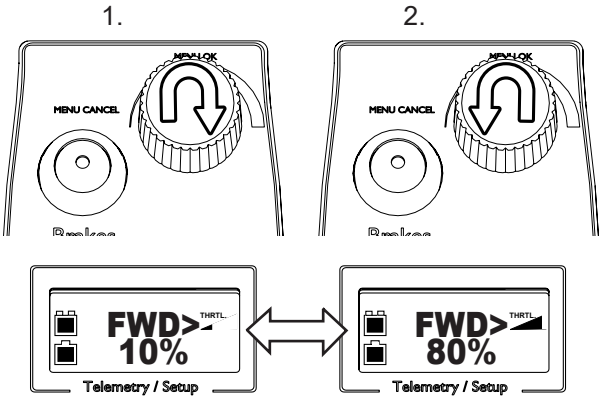


5. Control of your locomotive

Setting speed:

Make sure the brakes or brake lock are not active.

1. Turn the knob clockwise to increase speed.
2. turn the knob counter clockwise to decrease speed.

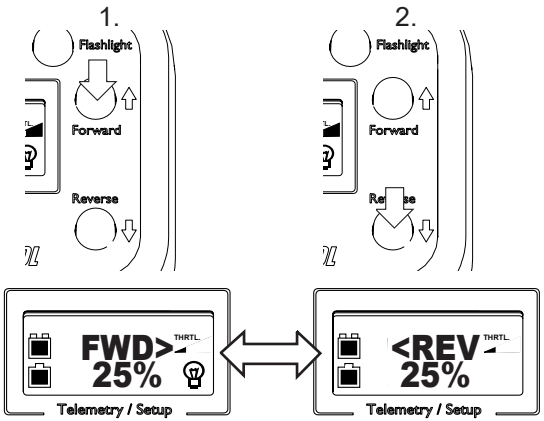


Changing direction:

1. press ‘forward’ to change the direction to forward travel

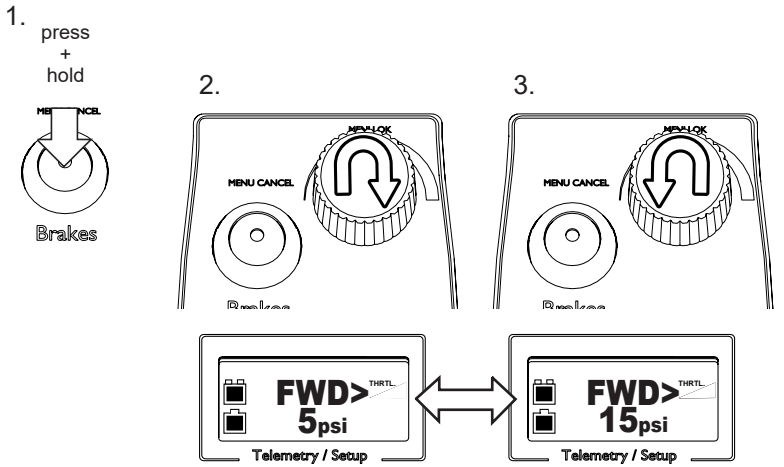
2. press ‘reverse’ to change the direction to backward travel.

Depending on the setting of reverse limit in the Setup menu (page 18). you can change the direction into the opposite way of travel while the locomotive is throttled up. It will slow down and then reverse into the opposite direction



Applying brakes: (With brake controller)

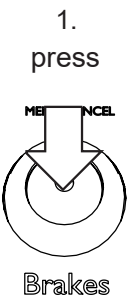
1. Press and hold the brake button. Throttle will be automatically reduced to 0% and brake pressure applied at the set value. (factory setting is 15psi)*
2. Rotate the knob clockwise to increase pressure.
3. Rotate the knob counter clockwise to decrease pressure.

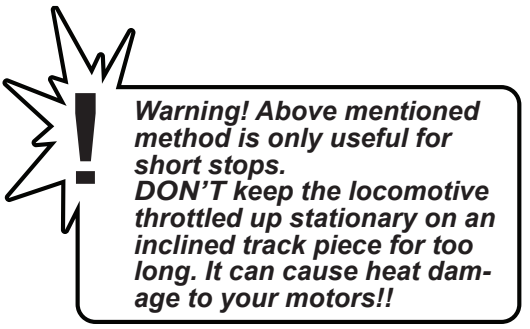


Stopping/slow down:(Without brake controller)

1. Press the Brake button. Throttle will be reduced to 0%. The four quadrant motor drive of the CC50A will slow down the locomotive to a stop on an even surface.**

if you are on an inclined track piece , the locomotive might continue to slowly creep forward or backward down the track. ***You can prevent this by giving a little bit of throttle in the opposite direction of travel***





* Please Note that this is reversed when you set the Brake Button mode to inverted in the Setup Menu. Not pressing the button operates the brakes in inverted mode. While pressing it means you can change the speed.

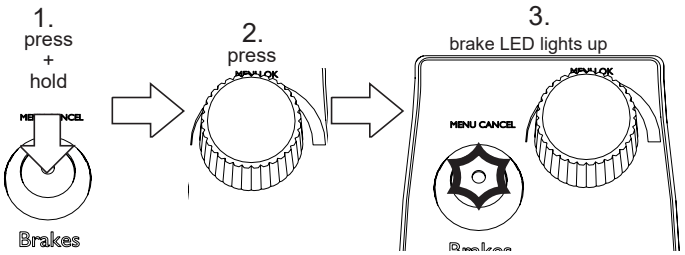
** When the brake button is set to inverted, releasing the button will stop the locomotive, while pressing it means you can change the speed.

Locking brakes: (With brake controller)

1. Press and hold the Brake button.
2. Press knob.
3. Release both brake button and knob.

The red LED on the brake button will light up, indicating that the brake-lock mode is now active

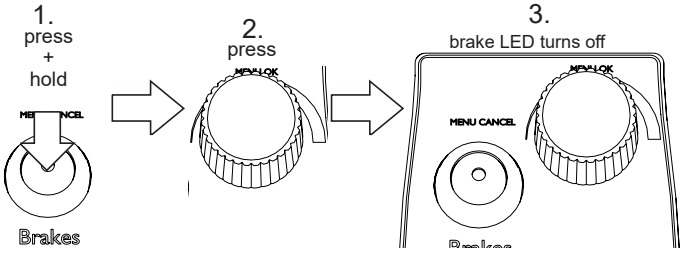
Note: Without brake - controller, this function does only maintain a throttle value of 0. The locomotive might still creep on an inclined track piece.



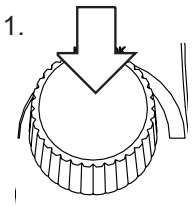
Unlocking brakes: (With brake controller)

1. Press and hold the Brake button.
2. Press knob.
3. Release both brake button and knob.

The red LED on the brake button turn off, indicating that the brake-lock mode is now inactive.

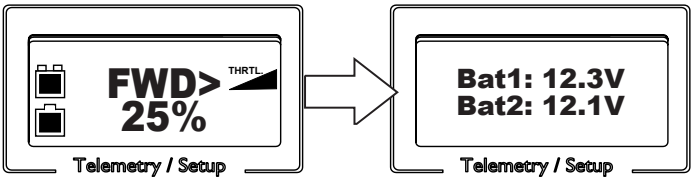


Checking locomotive battery voltages

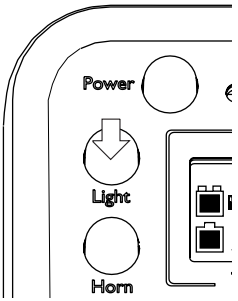


1. Press the knob while not in brake-lock mode. The display switches from showing the regular dash to a screen showing the voltages of the locomotive batteries.

This function does not work in Brake Lock mode



Turning on the lights

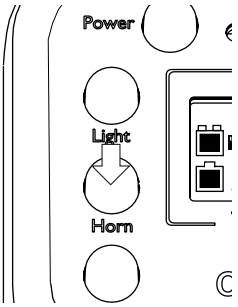


1. Press the “lights” button to turn on the headlights. They will be bright in the direction of travel and dimmed in the opposite direction. Meaning, at forward travel the headlight will be bright, the rear one dim.

2. Once the lights are on, you may dim them by pressing the button again. It will toggle back and forth between bright and dim setting.

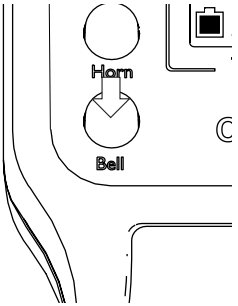
3. To turn the lights off, press and hold the button until the lightbulb symbol on the LCD disappears and the lights turn off.

Sounding the horn



1. Press the “horn” button, the horn should blow and keep blowing as long as you keep the button pressed. It will turn off as soon as you release the button

Turning the bell on and off



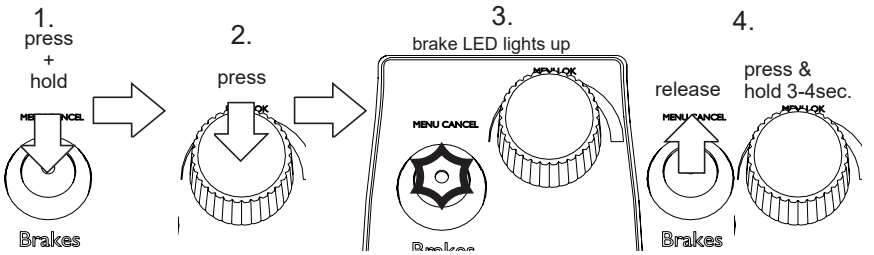
1. Press the “bell” button. This will turn the bell pulse signal on and will repeat until you turn the bell off again.

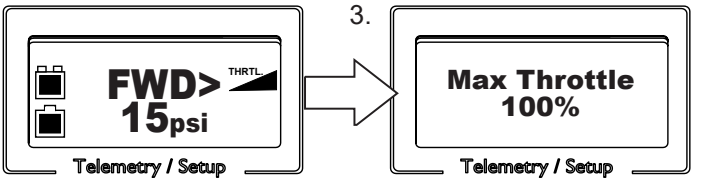
2. Press the button again to turn the bell signal off.

6. Setup Menu

Entering the Setup Menu:

1. Press and hold the brake button.
2. With the brake button held, press the knob.
3. release both brake button and knob. The red LED on the brake button will be lit (brake lock mode see page 9.)
4. Now press and hold the knob for a few seconds.
5. The handset enters the setup menu.





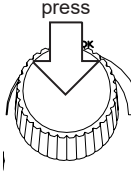
Changing menu settings.

1. Use the knob to choose which menu setting you want to change.
2. Press the knob to change the currently selected setting.
3. A rectangle will appear around the value.
4. Now use the knob to change the value.
5. Press the knob again and the menu will ask you if you want to save: Yes = save change. No = dismiss change.
6. Press the brake button (menu cancel) at any time and the handset will return to the dash in brake-lock mode. You can re-enter the menu by just holding down the knob again for a moment.

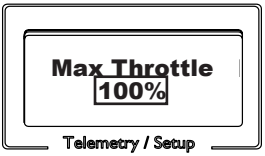
1.

press

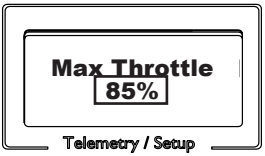
2.



3.

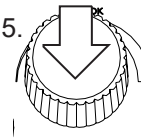


4.



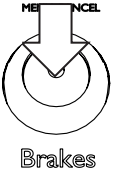
press

5.



press to exit

6.



List of available settings:

Name	Value Range
Max Throttle	10-100%
Default PSI	1-50psi
Maximum PSI	10-50psi
Acceleration	15-25% per sec
Deceleration	15-25% per sec
Wheel Diameter	3.0-8.0 inch
Deadman Time	1-30 seconds
Fall Time	1 - 100ms
RHL Dimming	level 1 to 4
Reverse Limit	5 - 50% of throttle
Deadman Mode	off / on
Brake button Mode	normal / inverted
Backlight Mode	off / fade / dim / bright

Please note that the CC50A controller needs to be turned on for the values to be stored internally. The System won't take the changes if the CC50A is turned off. Only settings that can be changed offline are:
deadman time, fall time, reverse limit, deadman mode, brakebutton mode and backlight mode.

Description of functions:

Max Throttle- Sets the maximum throttle. This gives the operator the ability to limit the maximum speed of the locomotive. I.E to have an inexperienced operator use the locomotive.

Default PSI- Sets the default pressure of the brake system to the value specified. This is the pressure setting that the system is set to at startup and at E-STOPs.

Max PSI- Sets the maximum pressure of the brakes

Acceleration- Sets the rate at which the locomotive will accelerate in percent per second.

Deceleration- Sets the rate at which the locomotive will decelerate in percent per second.

Wheel diameter- Sets the diameter of the wheel that the speed sensor is reading from. This setting is crucial for correct speed measurement.

Deadman Time- Sets the duration for timeout of the deadman system. The handset will stop the locomotive after this set of time if no input to any of the controls of the handset has been received.

Fall Time- Sets the timeframe in milliseconds the handset has to be in free-fall after being dropped before the drop detection triggers. (fall detection sensitivity)
shorter time = more sensitive longer time = less sensitive.

RHL Dimming- Sets the maximum brightness of the Rear Light.
Can be set to one of four levels with level 1 being the dimmest and level 4 being the brightest.

Reverse Limit- Sets the maximum speed where you can just reverse the locomotive with the directional buttons. (i.e traveling forward and then just reversing) The locomotive will slow down at the rate set in deceleration. then accelerate in the opposite direction at the rate set in acceleration.

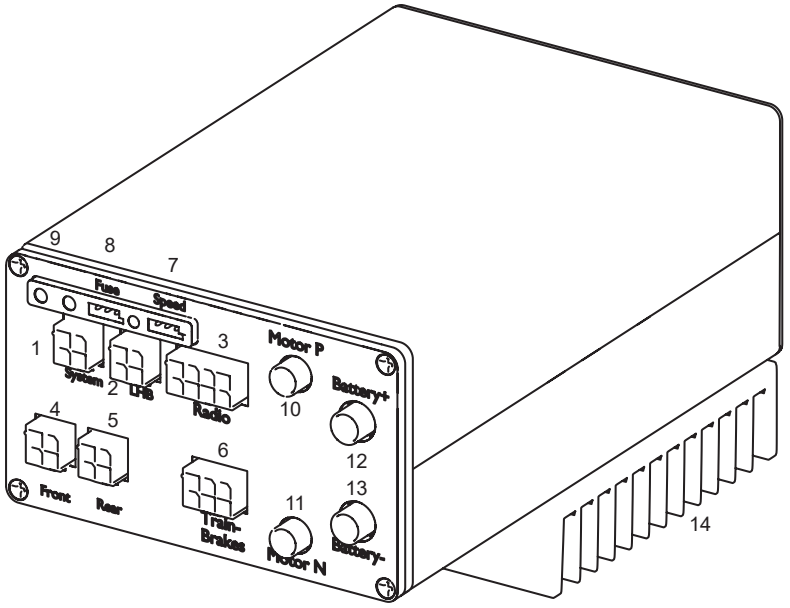
Deadman Mode- Turns the deadman mode on or off. When this is turned on, you have to keep rotating the knob or press any of the buttons to keep the deadman from timing out. The Timeout timeframe can be set with the “Deadman Time”. setting

Brake Button Mode- Sets how the Brake button is handled by the system.
normally the system sets speed via the knob until you press the brake button, then you set brake pressure and the locomotive stops.
in inverted mode, this is reversed. The system sets brake pressure, and the locomotive is stopped until you press the button, then it releases the brakes and you can set speed with the knob.

Backlight Mode- Sets the background light of the handset to one of the four following settings:
off = always off. (most battery saving)
fade = backlight turns on when any input is received then fades out (balanced)
dim = always on at a dim setting (moderate battery saving)
bright = always on at full brightness (least battery saving)

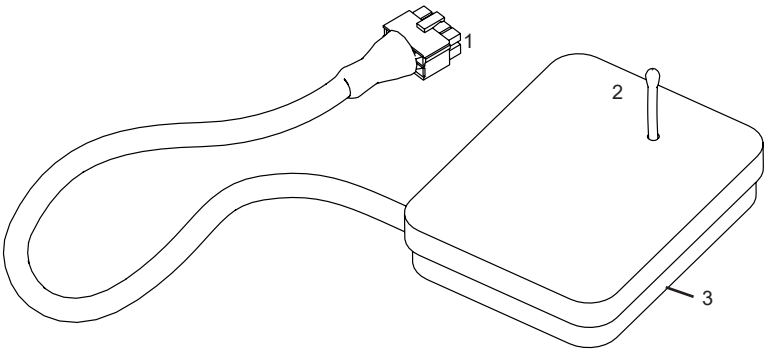
7. The CC50A (hardware set-up)

Connections of the CC50A



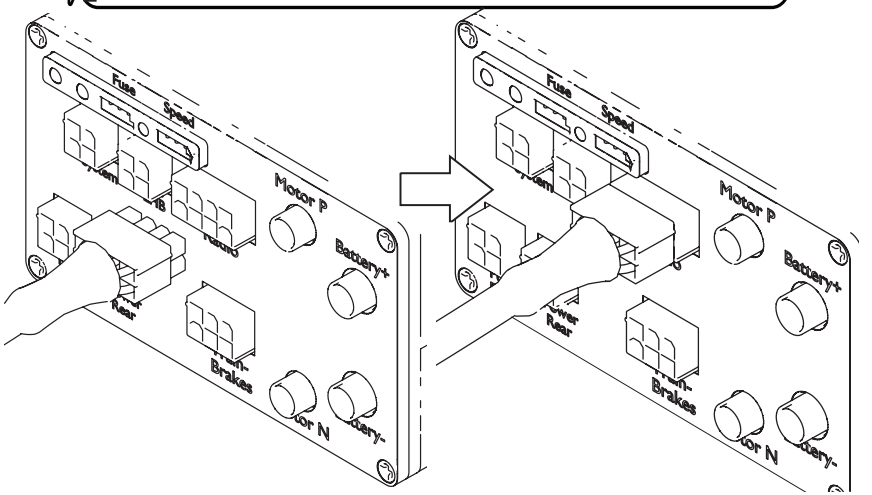
connector	connections
1. System Connector	KSI, VBat1, Vbat2
2. Lights / Horn / Bell Connector	Front light, Rear light, Horn, Bell
3. Radio Connector	5V, GND, RX,TX, RTS,CTS,Radio-con
4. Front Power connector	12V,GND
5. Rear Power connector	12V,GND
6. Train Brakes connector	Apply,Release,PSI-input,12V,GND
7. Speed sensor input	Input, 5V, GND
8. Fuse sensor input	Input, 5V, GND
9. Main RY and Status LED	-
10. Positive Motor Lug	-
11. Negative Motor Lug	-
12. Positive Battery Lug	-
13. Negative Battery Lug(GND)	-
14. Heatsink	-

Installing the radio Tranceiver



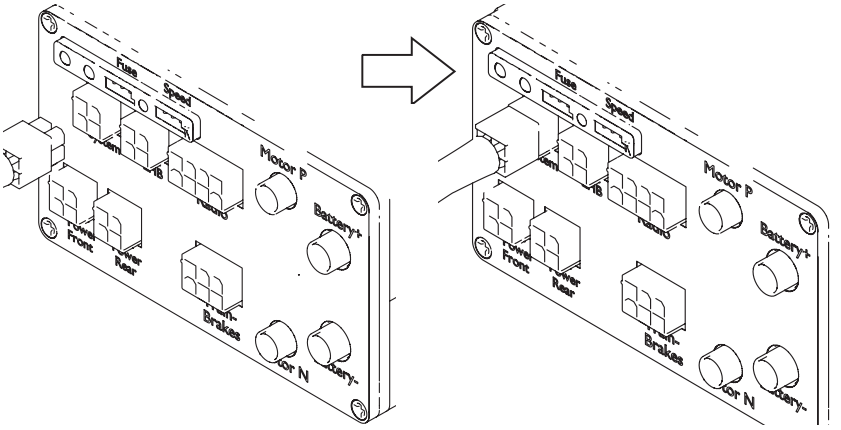
1. 8pin radio tranceiver plug
2. Radio antenna
3. Activity / Connection LED (on backside)

When you install the tranceiver you need to make sure that the antenna is clear of any obstructions



Plug the radio tranceiver into the 8 pin receptacle on the frontpanel of the CC50A controller

Installing the system connector



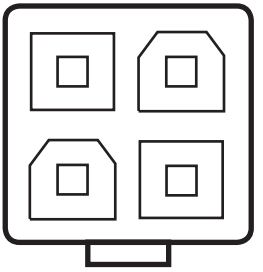
Plug the 4 pin system connector into the upper left 4 pin receptacle.

The pinout for this connector is as described here:

Key switch input (KSI)

This connection should be fused with a 3A Fuse (minimum) ***(mandatory connection)***

no connection



Battery 2 (24v system monitor)

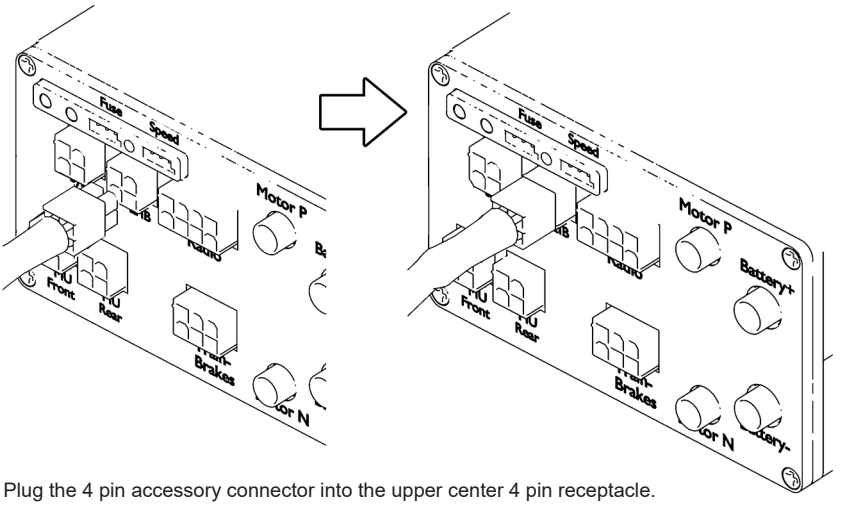
This connection should be fused with a 0.5A Fuse (minimum) ***(mandatory connection)***

Battery 1 (12v monitor)

This connection should be fused with a 0.5A Fuse (minimum)

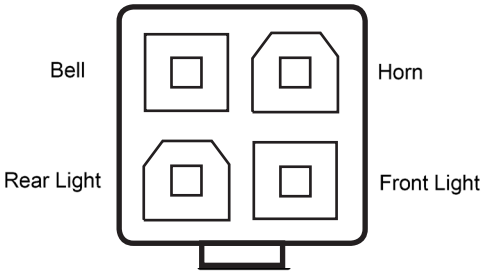
KSI and Battery 2 Are absolutely mandatory for installation. The system wont start up with either missing.

Installing the accessory connector



Plug the 4 pin accessory connector into the upper center 4 pin receptacle.

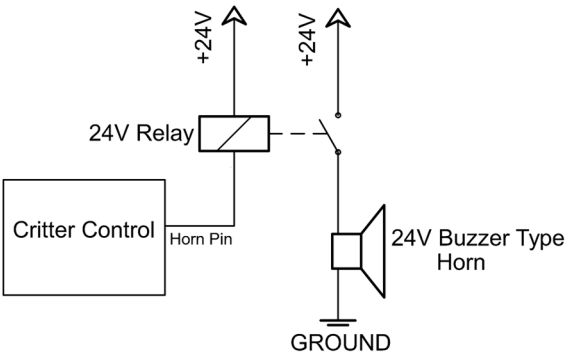
The pinout for this connector is as described here:



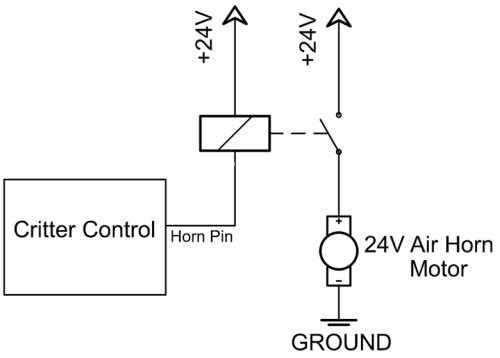
The Lighting pins can drive up to 4A (switched ground)
Bell and horn pins can drive up to 2A (switched ground)
Note: To drive a horn (air or buzzer type) you need to use a relay or the integral circuits horn controller.

Horn installation variants

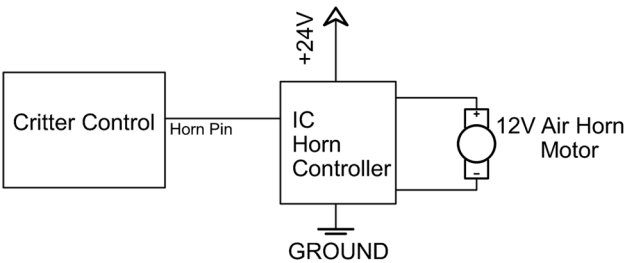
24V relay controlling a 24v buzzer type horn:



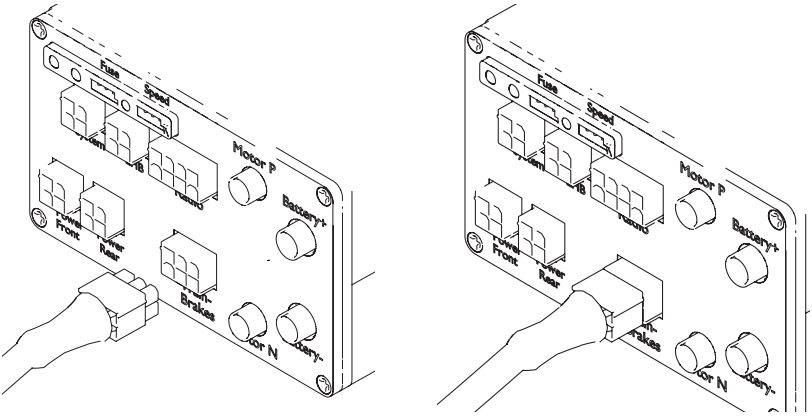
24V relay controlling a 24v Air Horn Compressor



Integral Circuits Horn controller for a 12V Air Horn Compressor

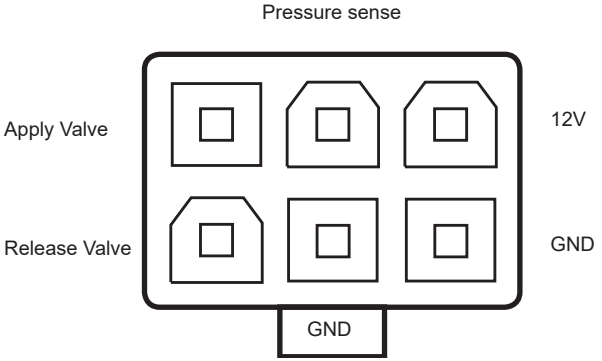


Installing the brake connector



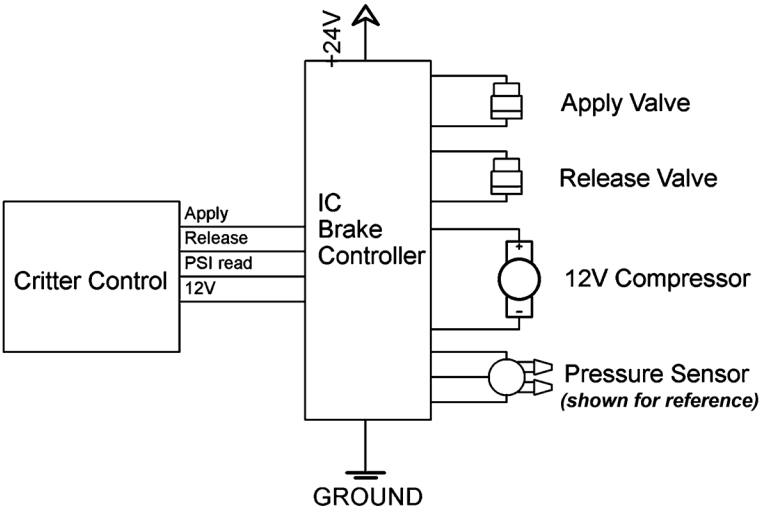
Plug the 6 pin brake connector into the lower right 6 pin receptacle.

The pinout for this connector is as described here:

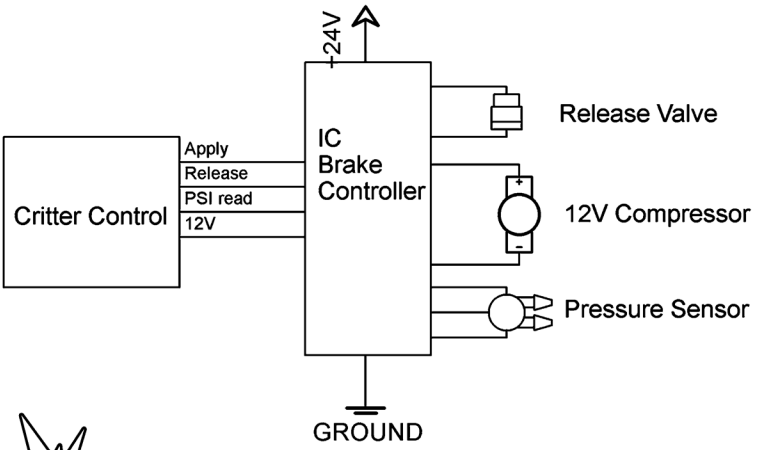


Integral circuits brake controllers come with a ready made control cable or attached cable depending on the model.

Brake controller installation diagram (BC100)

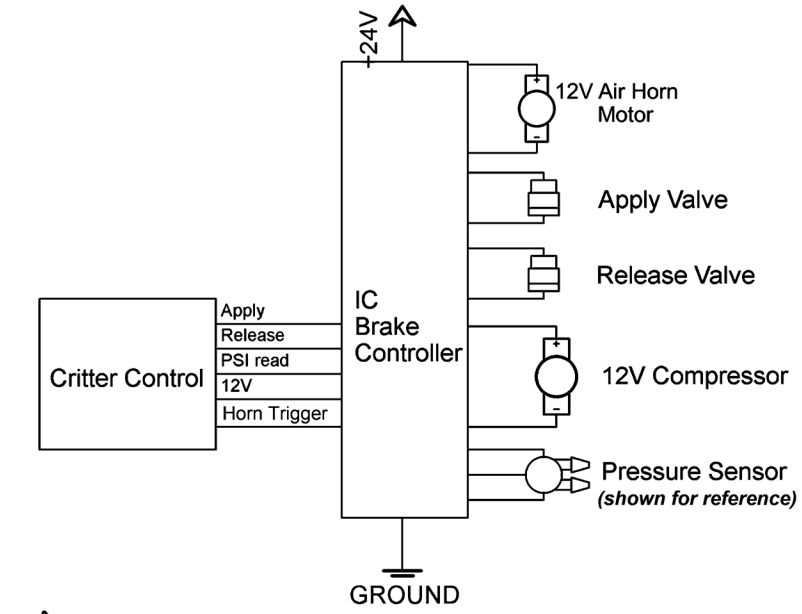


Brake controller installation diagram (BC50)



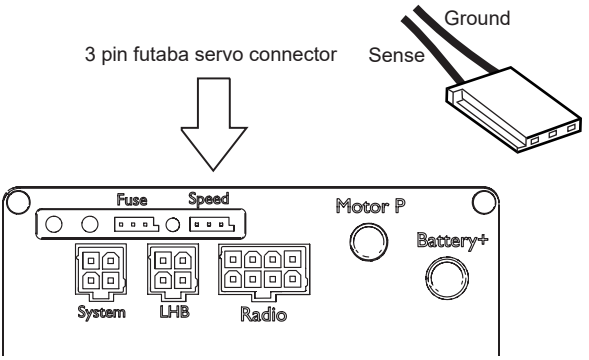
The Pressure sensor shown in this diagrams is actually inside the Brake Controllers. It does not have to be connected up electrically.

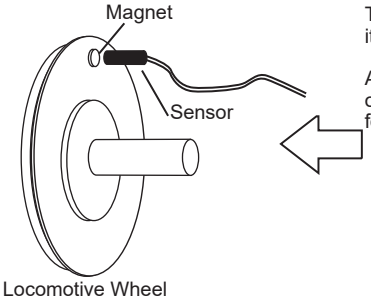
Combo controller installation diagram (BHC100)



The Pressure sensor shown in this diagrams is actually inside the Brake Controllers. It does not have to be connected up electrically.

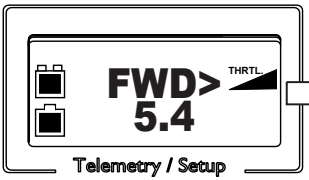
Installing the speed sensor





The CC50A needs a pulse signal to ground on its speed input connection to measure speed.

A simple reed switch and one single magnet on one of the wheels of the locomotive is sufficient for this.

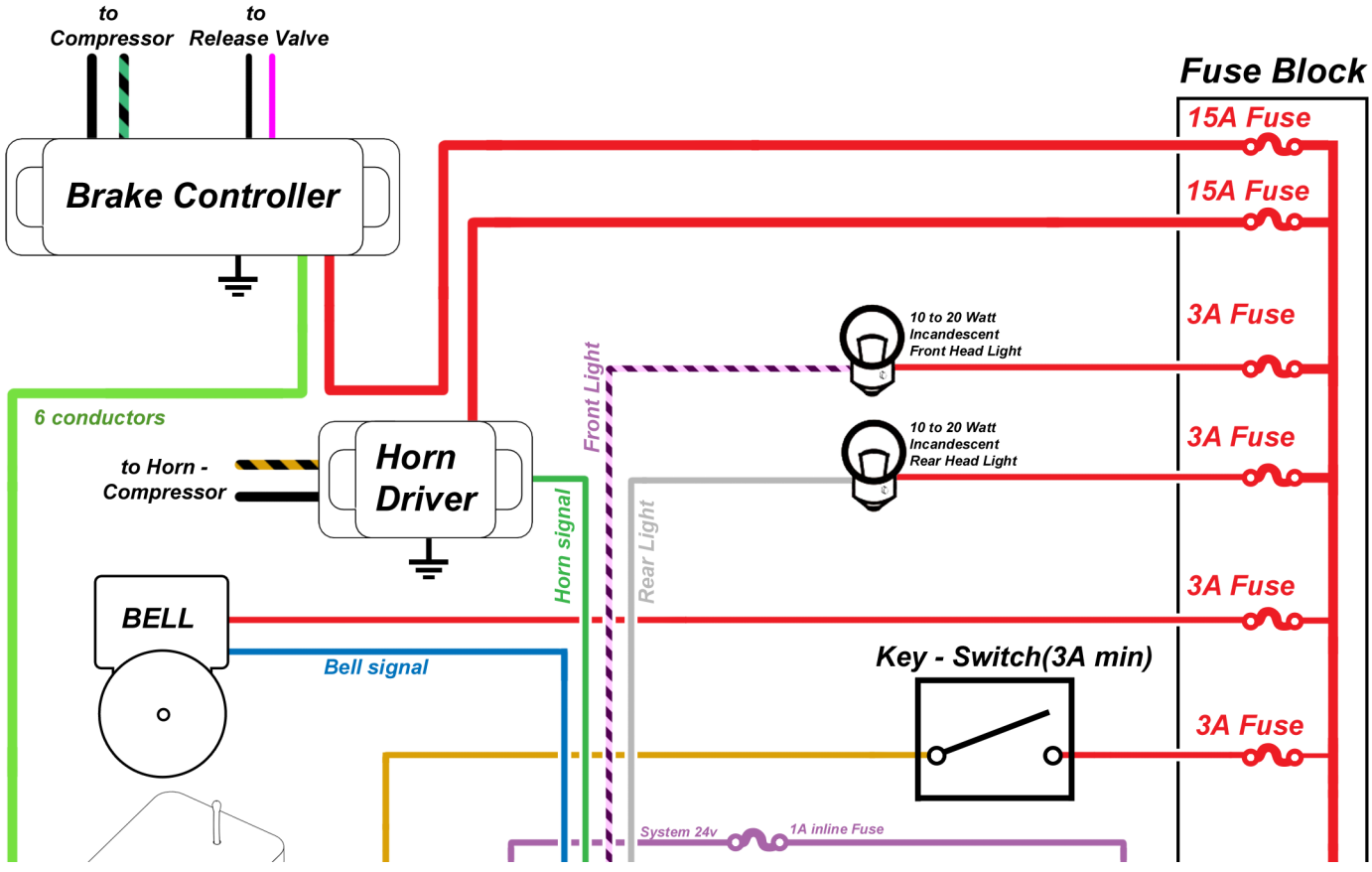


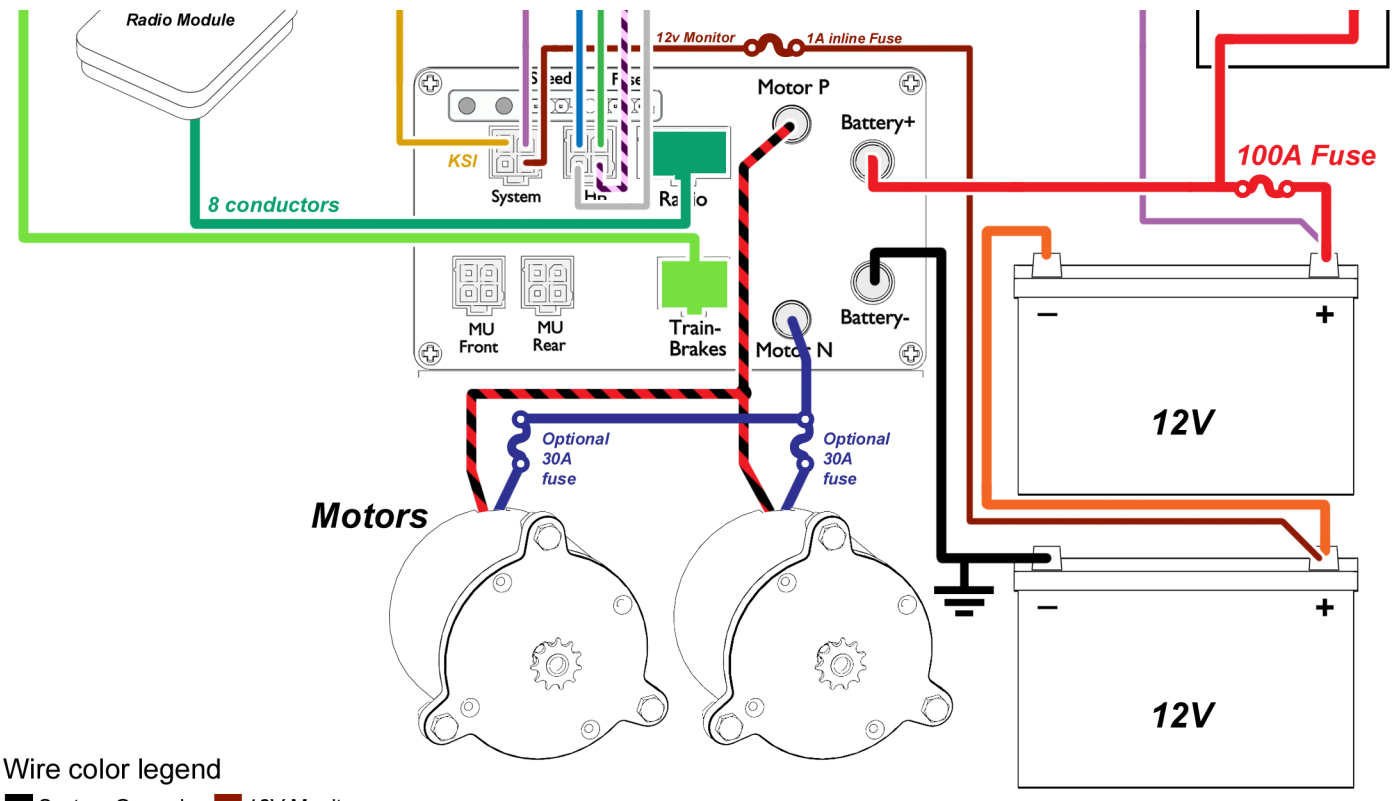
The Handset will show the speed in the same position as you normally see the throttle or brake pressure.
The speed is shown in decimal as real miles per hour.
Like in the the example on the left where it shows the locomotive traveling at 5.4 miles per hour.

For this to work right, you need to set the according wheel diameter of your locomotive in the Setup menu (page 17)

Notes

9. Wiring Diagram





Wire color legend

- System Ground
- 12V Monitor
- 24v VCC
- 24V System Mon.
- Battery center
- Key Switch Input
- Horn Signal
- Bell Signal
- Front Light
- Rear Light
- Motor Positive
- Motor Negative
- Brake compressor 12V
- Horn compressor 12V

Notes

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