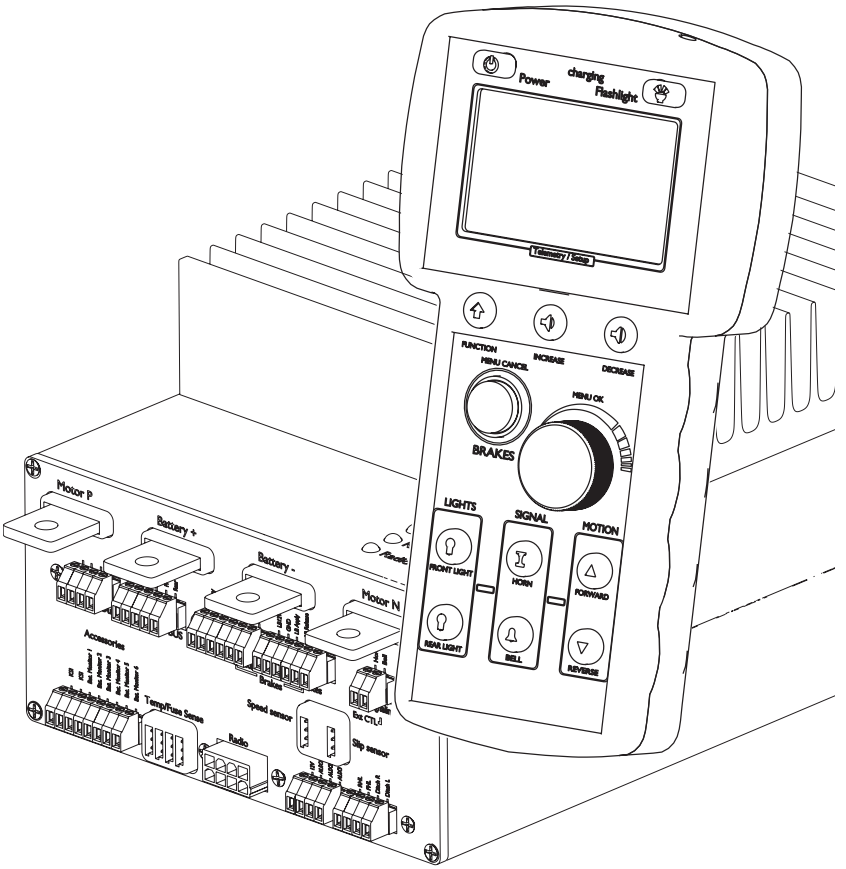
LOCOnTROLLER
Model LT 150 A



User Manual

INTEGRAL CIRCUITS

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The LT150A 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.

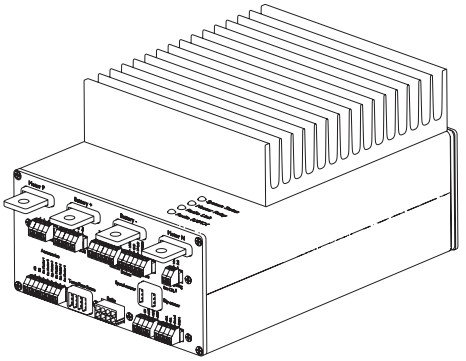
1. Introduction

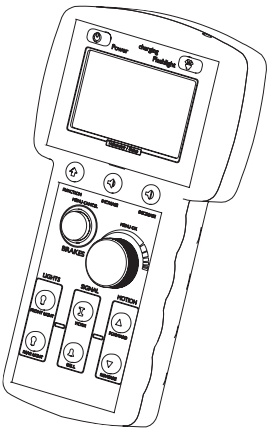
What's in the box?

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

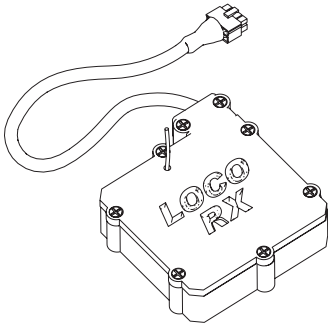
If this system got delivered pre-built into a locomotive, make sure that these items are listed by your seller and nothing is missing.

LT150A Locomotive control unit

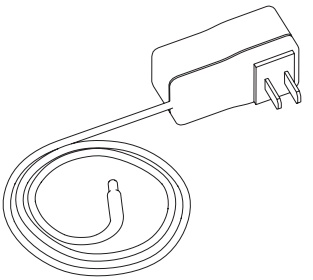




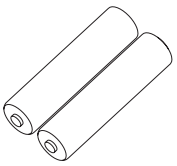
LT150A Remote control Handset



LT150A Radio Tranceiver (*picture might differ, depending if the wire antenna or External antenna version was ordered*)



12V Charger for LT150A Handset With MU Port Socket



Set of AA Rechargeable Batteries

Additional Items:

1. Bag of Phoenix connectors (1x 8pin, 2x 6pin, 1x 5pin, 3x 4pin, 1x 2 pin)

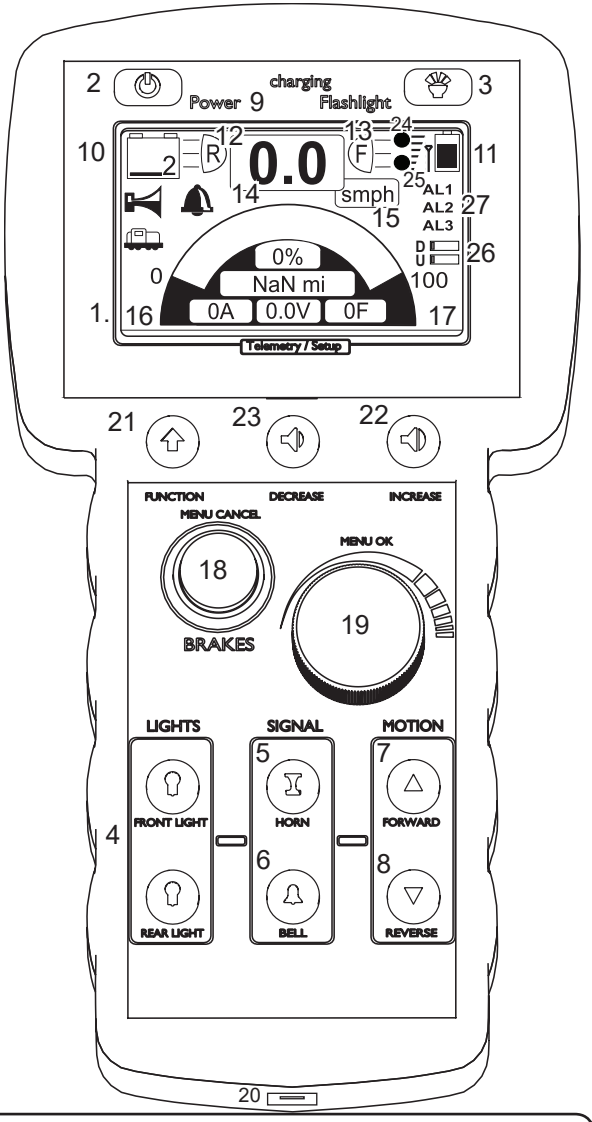
2. MU Rear Port Cable, for handset charging

3. This manual

4.(optional) Ballast resistors for LED lighting

5.(optional) Radio Tranceiver Extension Cord

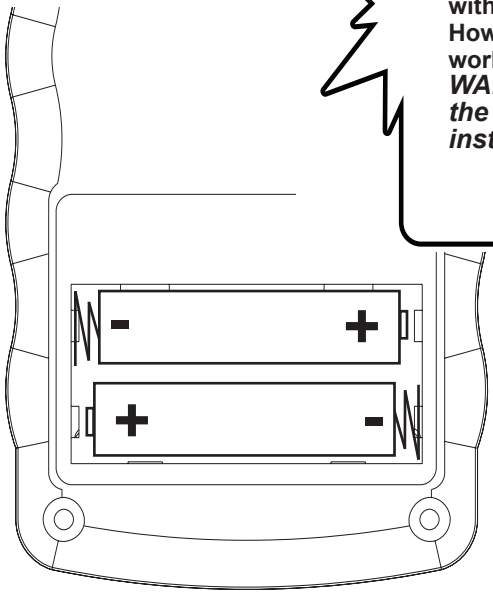
1a. THE LT150A HANDSET



1. Main Display
2. Power Button
3. Flashlight button
4. Light buttons
5. Horn button
6. Bell button
7. Forward button
8. Reverse button
9. Charging indicator
10. Locomotive Battery Indicator
11. Remote Battery Indicator
12. Rear light Indicator
13. Front light indicator
14. Speed/PSI indicator
15. Speed format indicator
16. reverse indicator
17. forward indicator
18. brake button
19. control Knob
20. Charging port
21. Function button
22. Volume up
23. Volume down
24. Ditch Light Indicator
25. Signal Strength indicator
26. Data Load Meters (Down and upstream)
27. Aux Panel

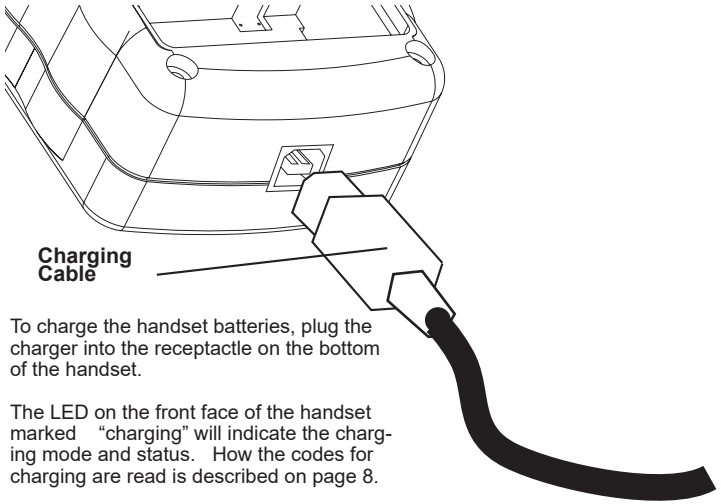
2. Handset - Before first use

Inserting the rechargeable batteries into the handset.



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

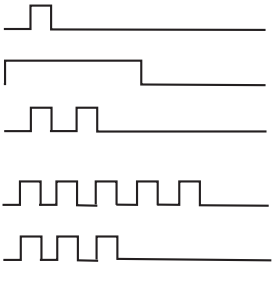


To charge the handset batteries, plug the charger into the receptactle on the bottom of the handset.

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

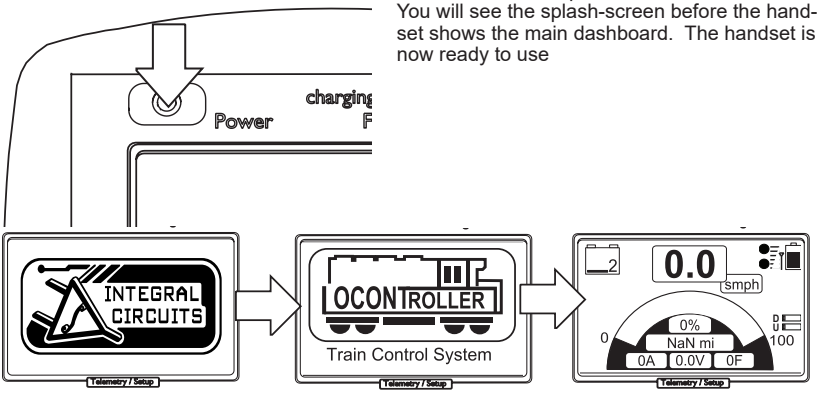
Post charge constant voltage mode - 3 short flashes

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 a seconds. You will see the splash-screen before the handset shows the main dashboard. The handset is now ready to use



No Link To locomotive.

When the locomotive is not turned on within 10 to 15 seconds the Handset will Time-out and show that it can't find the locomotive.

Turn the locomotive on, and then press the brake button once it is running. The message will disappear and the system is ready.

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"

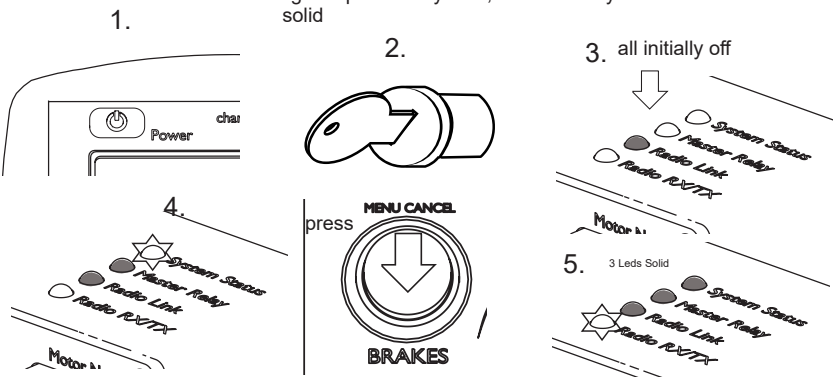
3. System startup procedure

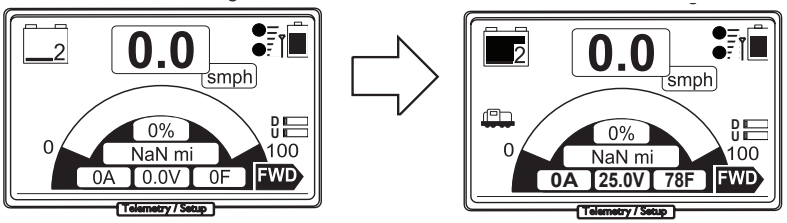
Startup:

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 LT150 A 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

4.a The Locomotive Link symbol (on left of screen) will show up

5. press the brake button on the handset until the system LED lights up solid . System, Master Relay and Radio link should be solid



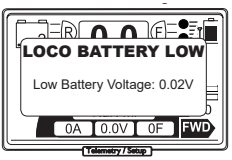


Dashboard fills with Telemetry.
Locomotive Link symbol appears(left)

Startup Error Messages:

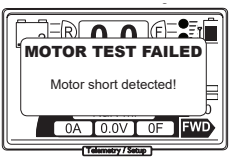
These error messages appear if any of the system checks at startup return a negative result.

The controller will check for battery voltage and motor drive/motor health, before it unlocks the system for use



Low locomotive battery error:

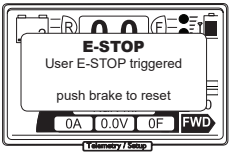
Symptom:	Solution:
Battery voltage shows 0	Check the wire and fuse for the battery monitors
Battery voltage is ~ 22V	24V sys Locomotive batteries need recharged.
Battery voltage is ~ 33V	36V sys Locomotive batteries need recharged.



Motor test failed error:

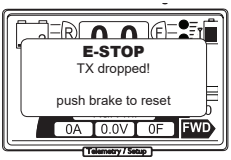
Symptom:	Solution:
Motor short detected!	Check the wiring of the motors for shorts. Check the motors directly for shorts.

4. System and Error Messages

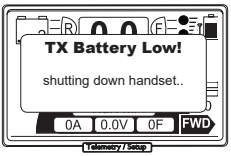


User E-STOP:
This message shows when the power button is pressed while the system is in operation.
It indicates that the locomotive entered the emergency stop state.

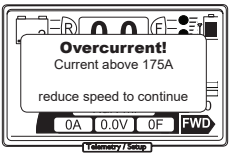
This can be cancelled with a push of the brake button.



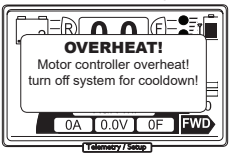
Dropped handset E-STOP:
This message shows whenever the handset is dropped and been in freefall for longer than the period specified in the setup menu. (“fall time” page 17.)



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 175A 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.



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.

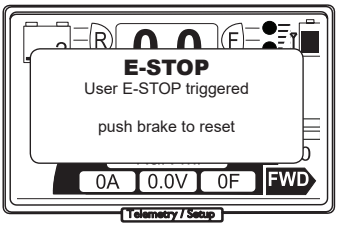
This message can not be dismissed until the locomotive and handset have been power cycled
System cool down before further use is adviced!

LINK LOSS!:
The Remote is not receiving any telemetry or heart-beat signal from the locomotive. This can be the result of a bad reception, out of signal range or loss of power in the locomotive.

This message can be dismissed with the push of the brake-button. However, it will come back until the link to the locomotive has been re-established.

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.

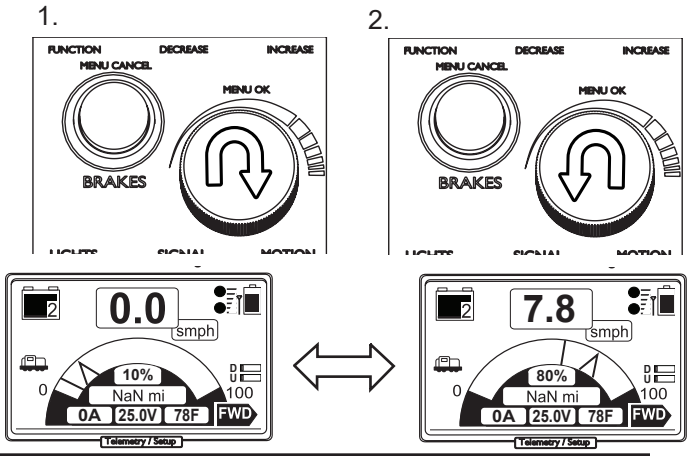


5. Control of your locomotive

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.

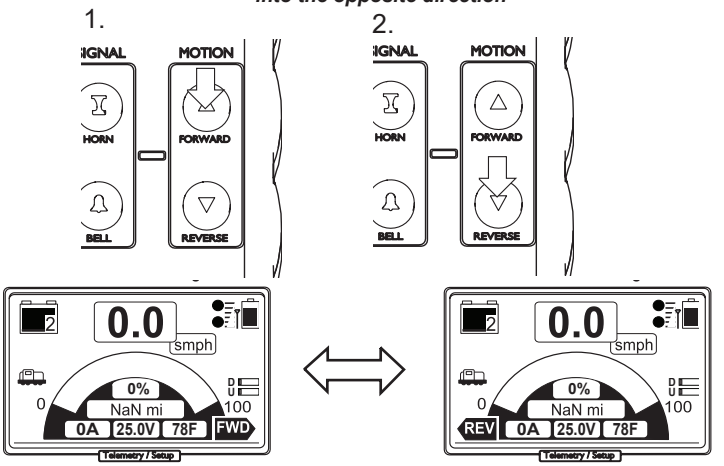


Changing direction:

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

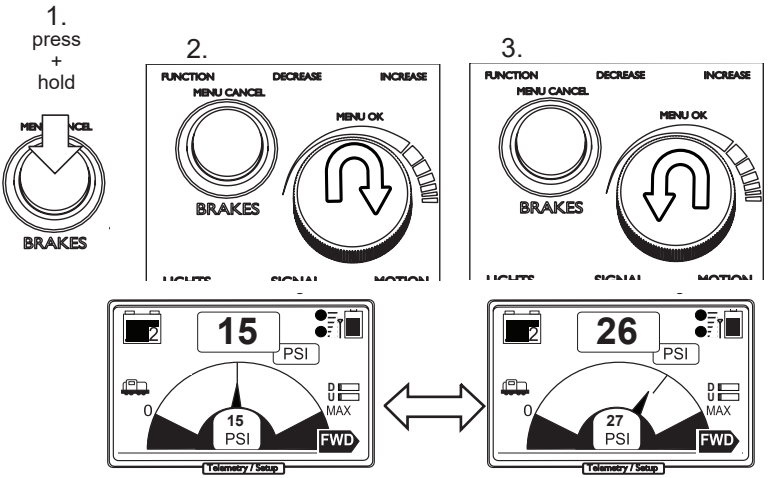
2. press ‘reverse’ to change the direction to backward travel.

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, or custom air-brakes installed)

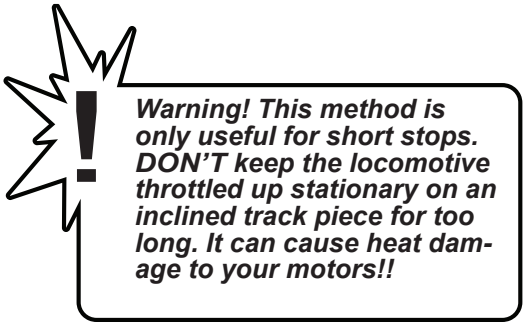
1. Press and hold the brake button. Throttle will be automatically reduced to 0% and brake pressure applied at the set value. (factory setting is 25psi)
2. Rotate the knob clockwise to increase pressure.
3. Rotate the knob counter clockwise to decrease pressure.



Stopping/slow down:(Without brake controller)

1. Press the Brake button. Throttle will be reduced to 0%. The four quadrant motor drive of the LT150A 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***

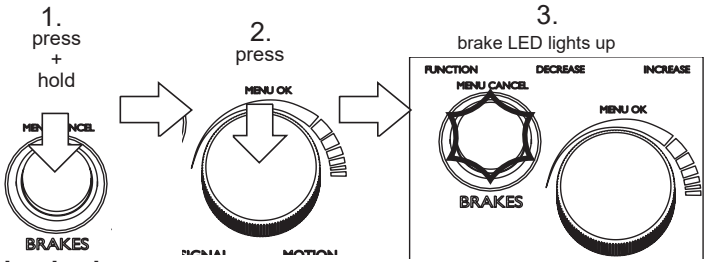


Locking brakes: (With brake controller, or custom air-brakes installed)

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

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

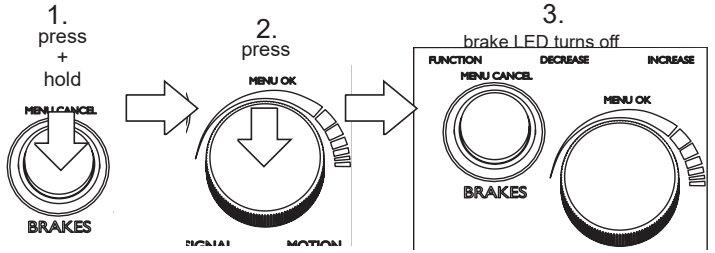
Note: Without brake - controller, this function does only maintain a throttle value of 0. The locomotive might still creep on an inclined track piece.



Unlocking brakes: (With brake controller, or custom air-brakes installed)

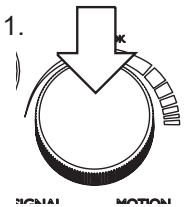
1. Press and hold the Brake button.
2. Press knob.
3. Release both brake button and knob.

The brake button light will turn off, indicating that the brake-lock mode is now inactive.

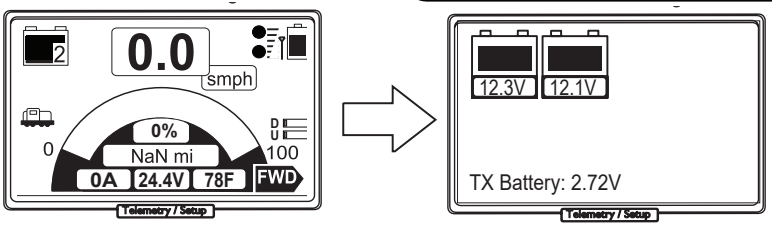


Checking locomotive battery voltages

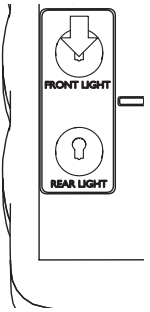
1. Press the knob while not in brake-lock mode. The display switches from showing the regular dash to a screen showing the voltages of the locomotive batteries.



This function does not work in Brake Lock mode



Turning on the front light

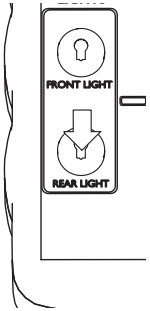


1. Press the front light button

2. Once the front light is on, you may dim it by pressing the button again. It will toggle back and forth between bright and dim setting.

3. To turn the front light off, press and hold the button until the front light symbol on the LCD disappears and the front-light turns off.

Turning on the rear light

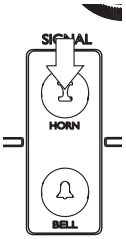


1. Press the rear light button

2. Once the rear light is on, you may dim it by pressing the button again. It will toggle back and forth between bright and dim setting.

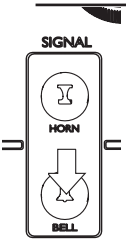
3. To turn the rear light off, press and hold the button until the rear light symbol on the LCD disappears and the rear-light turns off.

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



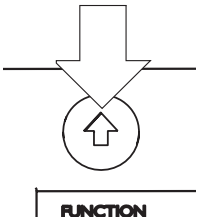
1. Press the “bell” button. This will turn the bell pulse signal on and will repeat until you turn the bell off again.*

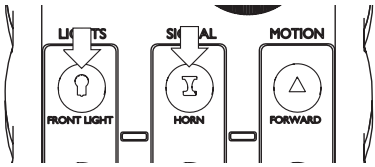
2. Press the button again to turn the bell signal off.*

*** Please note that both functions (horn and bell) are bound to the installed sound-module. And depending on what module was used, there might be a slight lag of response (we use Econami,Tsunami or Loksound modules, depending on customer order)**

Ditch Lights

Press and hold

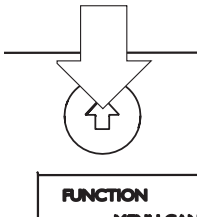




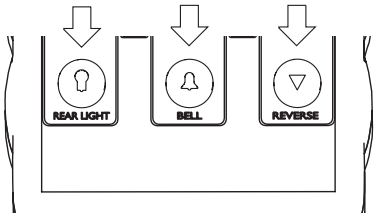
Ditch On/off Ditch Flash

Aux channel:

Press and hold



press any of the Aux buttons

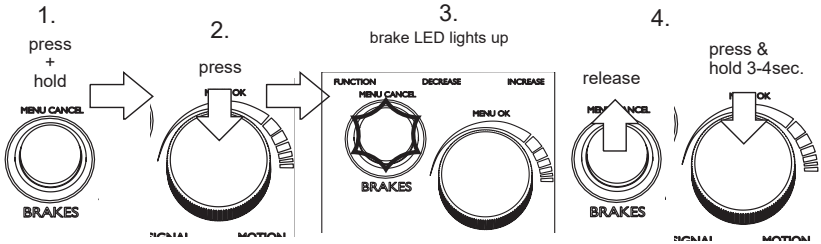


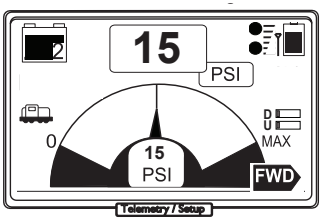
Aux1 Aux2 Aux3

6. Setup Menu

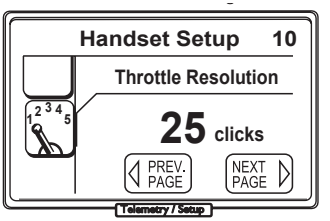
Entering the Setup Menu:

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. until the handset enters the setup menu.





5.

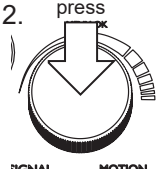


You can change the menu page via ‘increase’ and ‘decrease’ buttons

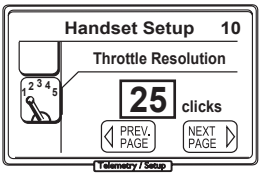
Changing menu settings.

1.

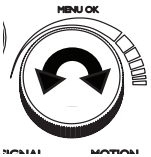
2. press

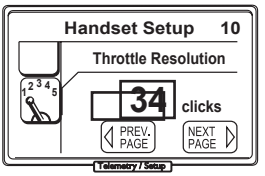


3.

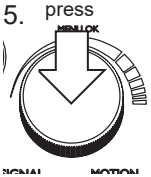


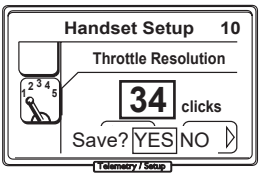
4.





5. press





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.

6. press to exit

List of available settings:

Throttle Resolution
Backlight on/off
Dead manTimeout
Speed Format
Drop Sensor
Autoreverse Limit

Maximum Speed
DefaultBrake PSI
Max Brake PSI
Acceleration
Deceleration
Wheel diameter
Electric or Gasoline
Battery Count
Load Current Gain
Sensor Input 1
Sensor Input 2
Sensor Input 3
Sensor Input 4
Front Light Level
Rear Light Level
Ditchlight time
Lighting System
EStop deceleration
EStop Brake Pressure
Front light Dim
Rear Light Dim

Brake Prsr. deadband
Brake Prsr. offset
Current gain
Current offset
ADC Calibration
Temp Calibration

Sound profile
Rung 1
Rung 2
Rung 3
Rung 4
Rung 5
Rung 6
Rung 7
Rung 8

Description of functions:

Handset setup:

Throttle Resolution (range 8-100)	Sets the amount of clicks on the encoder it takes to get to full 100% of throttle
Backlight on/off (range on/off)	Sets the backlight to either On (fade mode) or off (stays off)
Deadman Timeout (0-30 seconds)	Sets the time it takes for the deadman to stop the locomotive when no input is received, in seconds
Speed Format (mph/smph/kph/skph)	Sets the format the system shows speed and distance.
Drop sensor (5-100ms)	Sets the sensitivity of the accelerometer inside the handset. This is the amount of time the handset has to be in free-fall before it E-stops
Auto-reverse Limit (1-50%)	Sets the threshhold for the autoreverse limit. The locomotive can be reversed, as long as it is not throttled up beyond this limit.

Locomotive setup:

Maximum Speed (10-100%)	Sets the maximum available throttle that can be set. Limits the maximum speed of the locomotive.
Default Brake Prsr. (0-50psi)	Sets the default brake pressure that is available upon system start. This is also the setting the Emergency stop feature uses by default.
Maximum Brake Prsr. (10-80psi)	Sets the absolute maximum brake pressure the system can reach.
Acceleration (1-50%/s)	Sets the acceleration behavior of the locomotive (how fast or slow it accelerates) in percent per second . a higher value means a faster acceleration
Deceleration (1-50%/s)	Set the deceleration behavior of the locmotive (how fast or slow it decelerates) in percent per second. a higher value means a faster stop
Wheel diameter (1.000 to 8.000 inch)	Sets the wheel diameter of your locomotive. This is needed for correct speed calculation via speed-sensor input. If you use the sensor on a flywheel (before a reduction occours) you need to divide your wheel diameter by that reduction and set it accordingly. (5" wheel 1:2 reduction = 2.5")
Electric or Gasoline	reserved setting. no function currently
Battery Count (2-6 bat)	Sets the amount of batteries in the system. This is needed to correctly calculate voltages and battery levels.
Load Current Gain (1-20)	Sets the gain for the sound module's rung calculation. at high loads the engine will sound more tasked.
Sensor input 1 to 4	Can be set either to fuse input (fuse detection) or Temperature sensor. **(This feature is currently only implemented but not enabled)**
Front Light Level (0-15)	Sets the global brightness of the front lights. Dim will be calculated from this too. (about half)
Rear Light Level (0-15)	Sets the global brightness of the rear lights. Dim will be calculated from this too (about half)
Ditchlight time	Determines how long the ditchlights keep flashing when triggered
Lighting System	Selects the type of lighting system and system voltage. Incandescent 24 or 36V 1 LED per channel @ 24 or 36 v 2 LED per channel @ 24 or 36V

(continued on page 18)

Description of functions (cont):

Loco Setup(Cont):

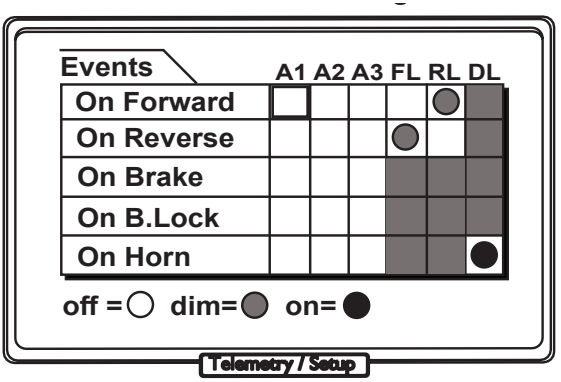
EStop deceleration	Sets the deceleration for the Emergency stop situation. This setting allows for a rapid deceleration without stoping the locomotive too hard.
EStop Brake PSI	Sets the pressure that is used in an Emergency Stop.
Front light Dim	Sets the Dim-level of the front light
Rear Light Dim	Sets the Dim-level of the rear light

Calibration Setup:	**These are Factory Calibrations that we set before shipping of the unit and usually do not ned to be changed manually**
Brake Prsr. deadband	Sets the deadband of the brake pressure sensor. Default is 1PSI
Brake Prsr. offset	Sets the voltage offset for the pressure sensor in use. The offset voltage can be found in the datasheet of most pressure sensors. by default this is set to a MPX5500 pressure sensor offset voltage
Current gain	Sets the scale multiplier for the current gain
Current offset	Sets the voltage offset of the current sensor in use.
ADC Calibration	Sets the multiplier for the Analog to Digital converter inside the Unit
Temp Calibration	Sets the Compensation value for the internal Temperature sensors

Sound Setup:

Profile	Sets different profiles which distribute the rungs being send to the sound module at different positions of the speed gauge. This is mainly used to match the various different sound modules available.
Rung 1	Sets the amount of throttle where Rung 1 will be triggered
Rung 2	Sets the amount of throttle where Rung 2 will be triggered
Rung 3	Sets the amount of throttle where Rung 3 will be triggered
Rung 4	Sets the amount of throttle where Rung 4 will be triggered
Rung 5	Sets the amount of throttle where Rung 5 will be triggered
Rung 6	Sets the amount of throttle where Rung 6 will be triggered
Rung 7	Sets the amount of throttle where Rung 7 will be triggered
Rung 8	Sets the amount of throttle where Rung 8 will be triggered

The Event System:



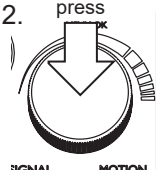
The event system gives the ability to assign functions of the locomotive controller to certain events happening during operation. At default the front and rear headlight are assigned for dimming operation on direction change. The ditchlights are assigned to the horn trigger.

Selecting a Event:

1. Use the knob to select the event on the grid you want to modify
2. press the knob
3. a menu will pop up that shows the different settings you can choose.
4. select the setting and press the knob again. The event is now assigned.

1.

2. press



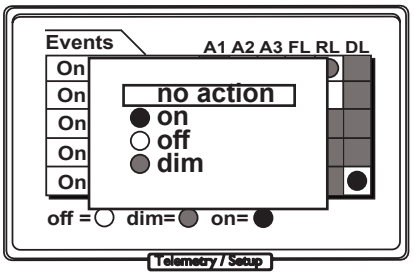
no action = nothing will happen, all functions remain as they were

on = the selected channel will turn on with the event and off again when the event is over.

off = the selected channel will be always on and only turns off with the event happening, same as the on state but inverted.

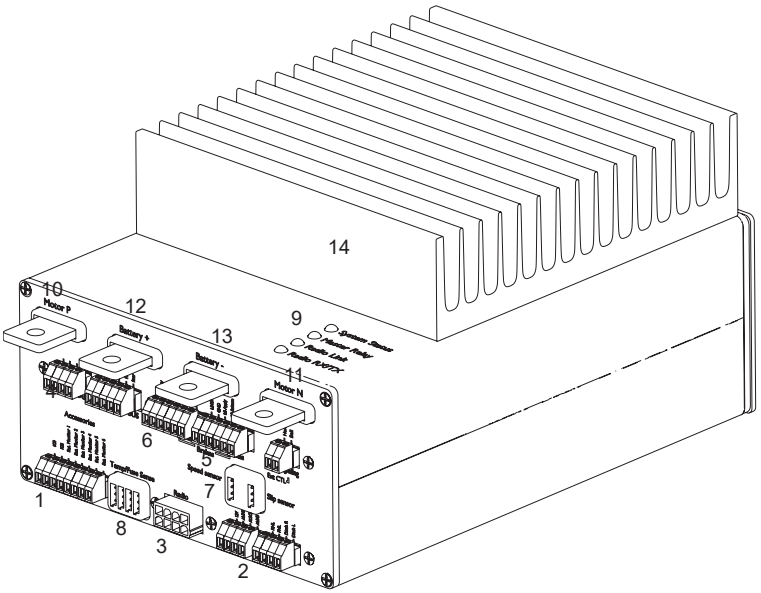
dim = only used for the headlights, choose if the lights dim on direction change or not.

3.



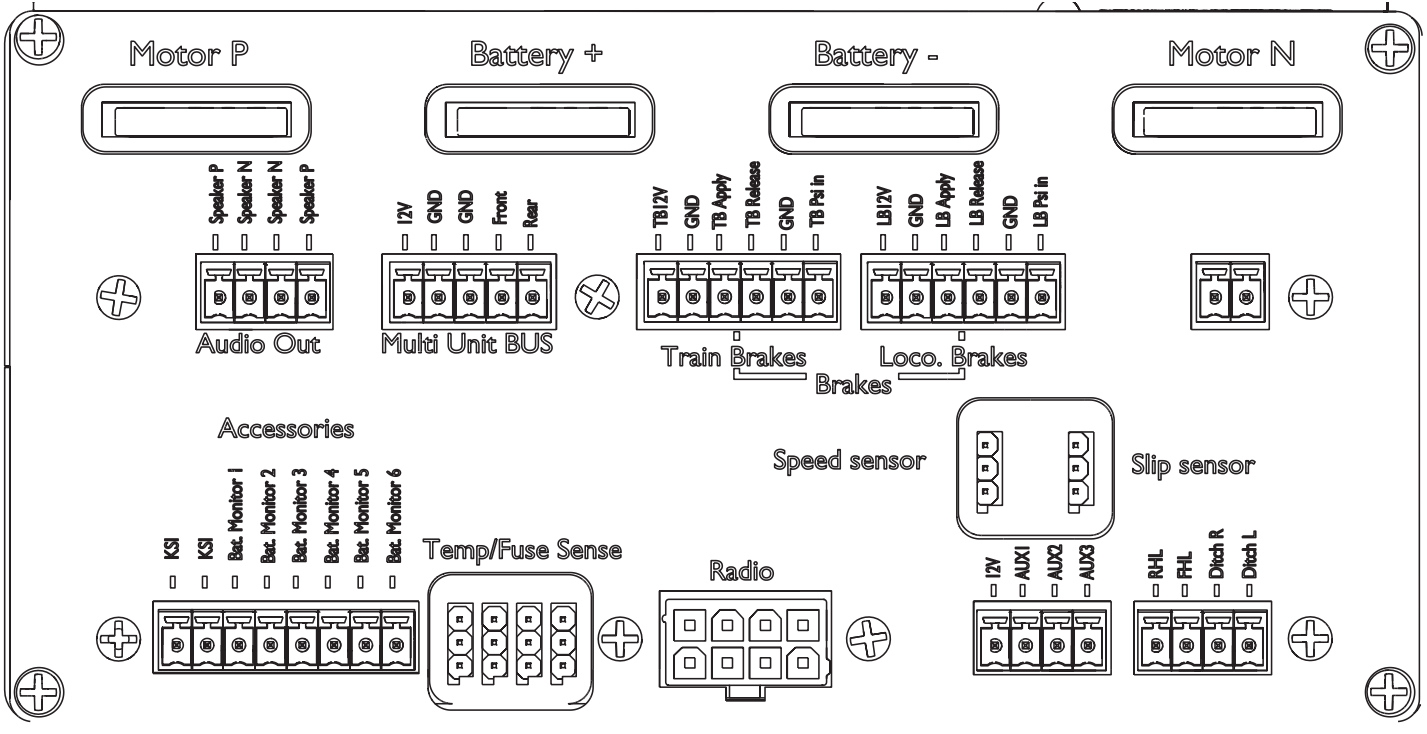
7. The LT150A (hardware setup)

Parts of the LT150A

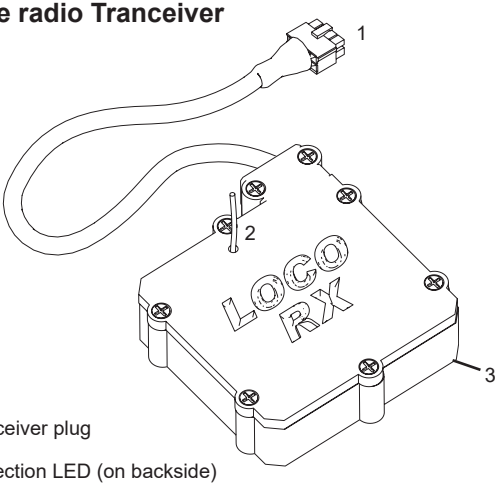


connector	connections
1. System Connector	-
2. Lights / Aux Connectors	
3. Radio Connector	
4. Handset charge / Mu connector	
5. Loco Brakes connector	
6. Train Brakes connector	
7. Speed sensor input	
8. Fuse sensor input	
9. System LED panel	
10. Positive Motor Lug	
11. Negative Motor Lug	
12. Positive Battery Lug	
13. Negative Battery Lug(GND)	
14. Heatsink	

7a. Front panel Pinout

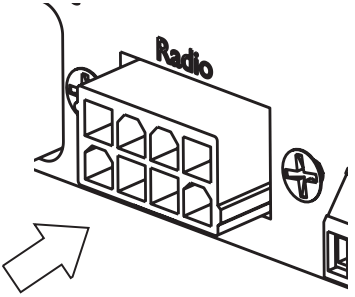


Installing the radio Tranceiver



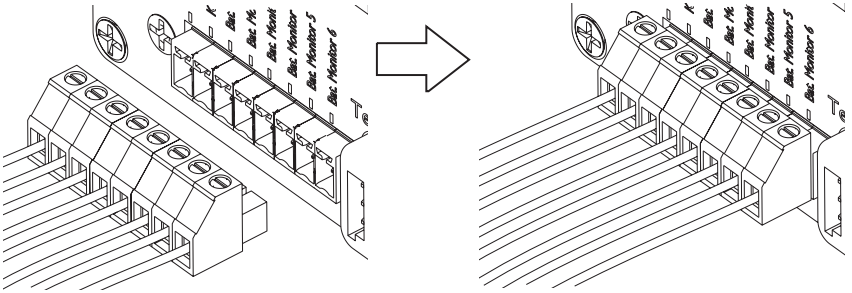
1. 8pin radio tranceiver plug
2. Radio antenna
3. Activity / Connection LED (on backside)

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



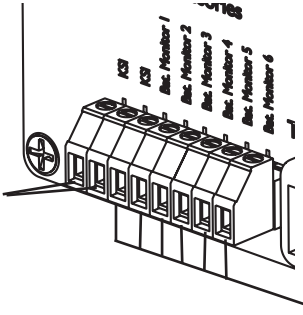
Plug the radio tranceiver into the 8 pin receptacle on the frontpanel of the LT150A controller

Installing the system connector



Plug the 8 pin Phoenix plug into the system monitor receptacle

The pinout for this connector is as described here:



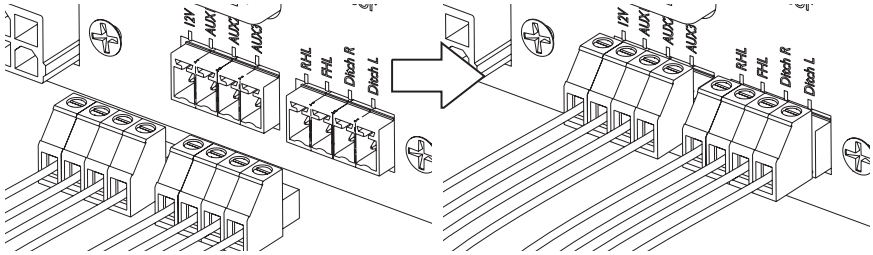
Key switch input (KSI)
This connection should be fused with a 3A Fuse (minimum)
(mandatory connection)

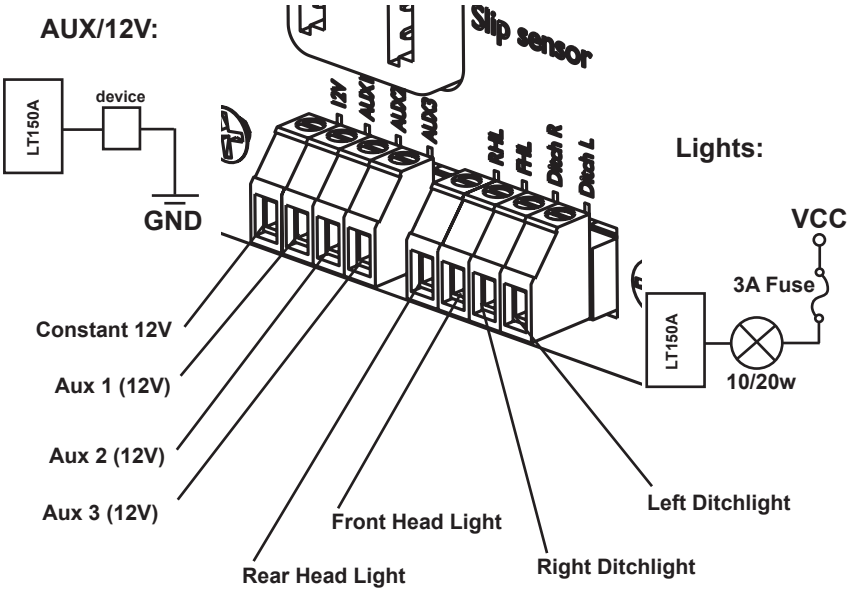
Battery monitors		
Bat Type:	**6v**	**12v**
Bat1	**6v**	**12v**
Bat2	**12v**	**24v**
Bat3	**18v**	**36v**
Bat4	**24v**	
Bat5	**30v**	
Bat6	**36v**	

Battery Monitor connections should be fused with a 0.5A fuse (minimum)

KSI and the battery monitors are absolutely mandatory for operation of the unit!

Installing the Lights and Aux Connector

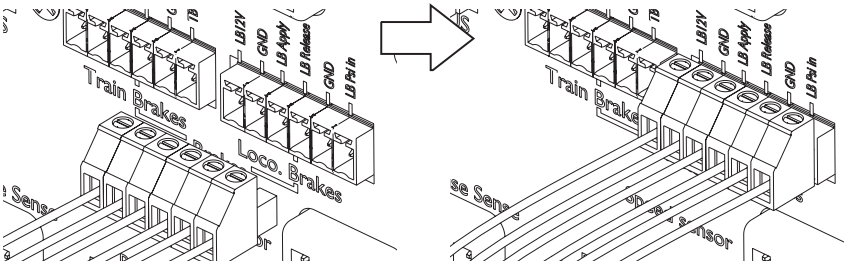




Make sure you do not mix the connection shemes up!

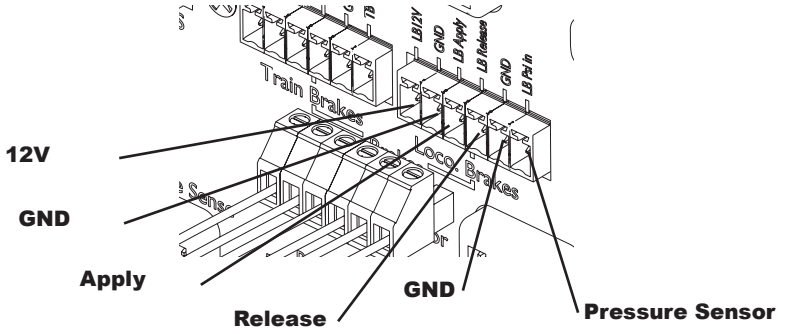
The Lighting pins can drive up to 4A (switched ground)
The Aux pins can drive up to _A (switched 12V)
The 12V Pin can drive up to _A

Installing the Loco brake connector



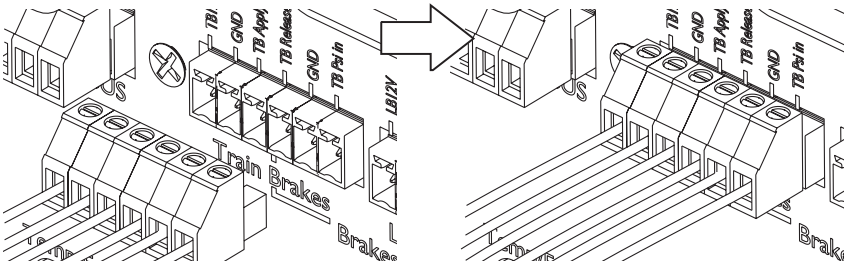
Plug the 6 pin brake phoenix connector into the Loco brake receptacle.

The pinout for this connector is as described here:



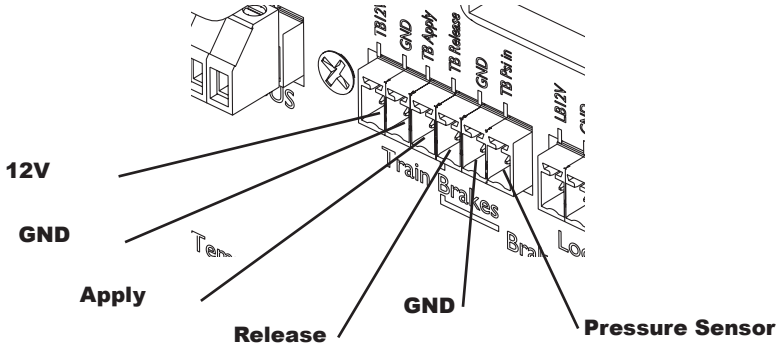
Integral circuits brake controllers come with a ready made control cable or attached cable depending on the model.

Installing the Train brake connector



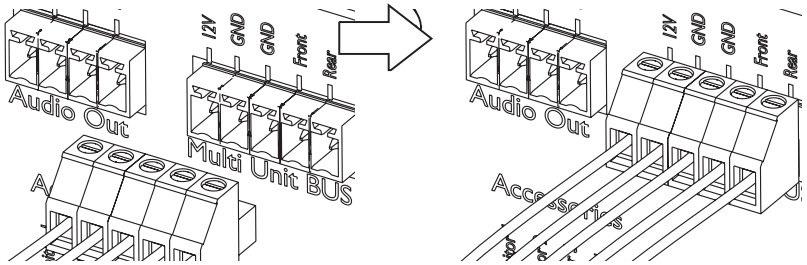
Plug the 6 pin brake phoenix connector into the Loco brake receptacle.

The pinout for this connector is as described here:



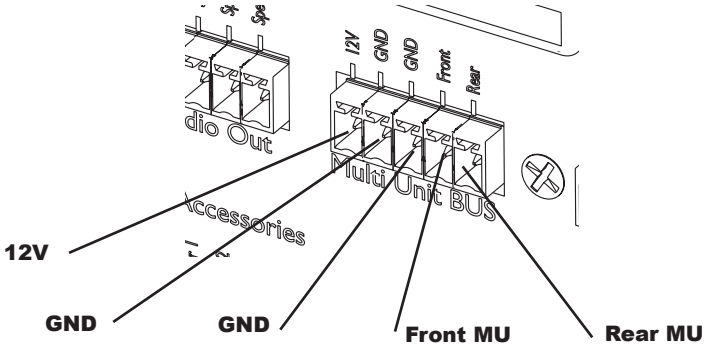
Integral circuits brake controllers come with a ready made control cable or attached cable depending on the model.

Installing the Multi unit connector



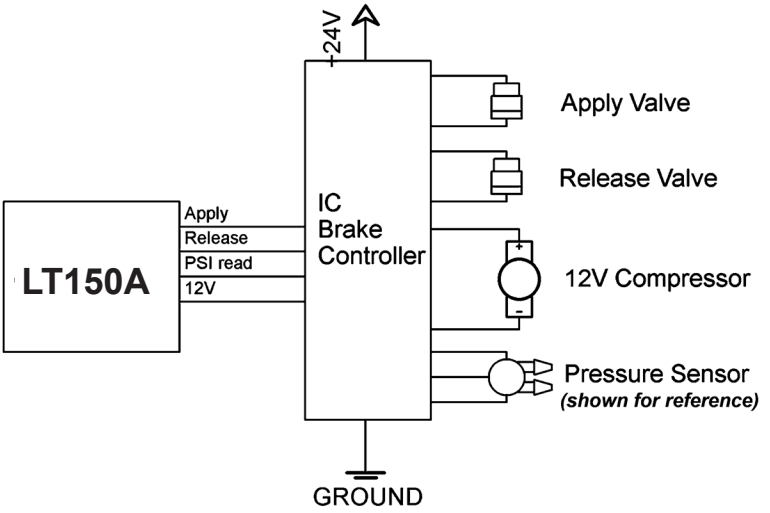
Plug the 6 pin brake phoenix connector into the Loco brake receptacle.

The pinout for this connector is as described here:

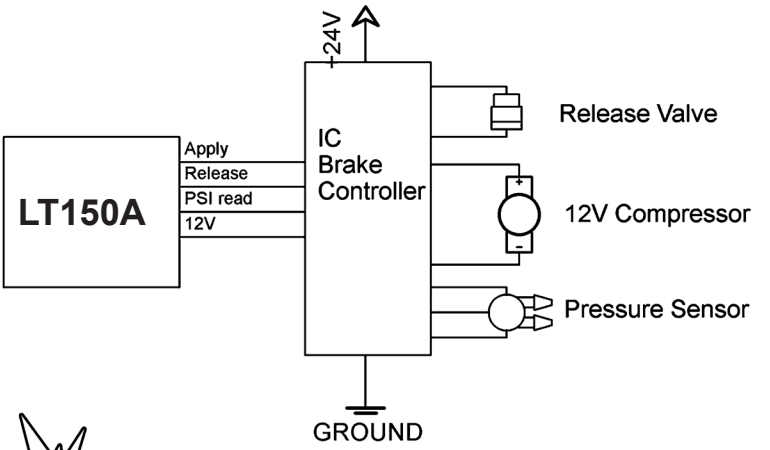


The LOCOnTROLLER comes with one pre-made MU connector for installation in the Locomotive body

Brake controller installation diagram (BC100)

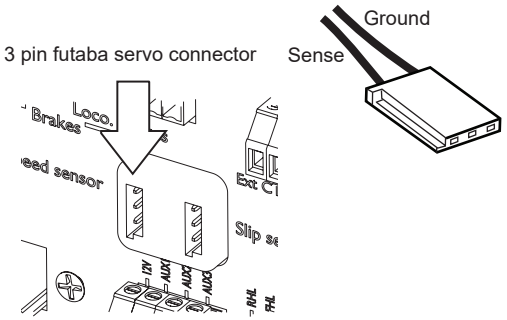


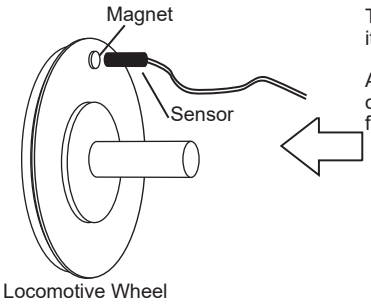
Brake controller installation diagram (BC50)



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

Installing the speed sensor





The LT150A 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 at the top of the dashboard . The speed is shown in the format you have set in the setup menu “speed format” (mph, smph , kph, skph)
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)

9. Wiring Diagram (provided Externally)

Notes

Notes