Ride on Railways Ltd

Earl Locomotive



A 7 ¼” Gauge Electric Steam Outline Locomotive.

OWNERS MANUAL

A large electric locomotive with all the elegance and charm of a traditional steam locomotive while providing the convenience, performance and durability of a modern electric locomotive.

Dimensions

Total Length	2.8m
Width	0.6m
Height of loco	0.9m – rail to top of cab
Weight of loco	230kg
Tender weight	
Wheel base of loco	0.45m
Wheel base of tender	0.45m
Wheel diameter	200mm (over flange) – EN8 steel
Axles	25mm diameter EN1A steel with 8mm key way slot
Bearings	UCT 204 self aligning bearings



Control and Power

Motors	2,3 or 4 Motors
Power	DC Geared Motor as follows: Motor Type: Brushed DC, 24V. Rated power options • 350w S25 duty cycle – 1hp peak input per motor. • 525w S25 duty cycle – 1.5hp peak input per motor Protection: IP40.
Transmission	Gearbox: Worm, 050 rectangular. Output: 400 rpm. Output shaft: 25.0mm diameter hollow. Low backlash allowing for free wheeling 8mm keyway
Motor Controller	Idrive – Penny and Giles Drive Technology (now t/a Curtiss Wright) 24v 180amp continuous • Programmable settings for acceleration/deceleration. • Character switch programmed on mid gear to provide 60% power. • Progressive regenerative braking – quicker you reduce power harder the braking. • On board fault logs and traction use timer (used by us when docked with pc) **Connections** • Power 6mm ring terminals • Control 14 pin minifit jnr connector • Aux 1 - 2 pin minifit jnr connector

Batteries	4 x 110 ah lead acid batteries – 2 in loco 2 in tender Batteries are connected in pairs to allow charging from charger mounted under the drivers seat.
Wiring	Battery leads 10mm^2 Motor connections 6mm^2 Control wire 16/0.2mm Accessories – 1mm^2
Interface	• Driver controls are made to mimic those found on real steam engines – regulator (throttle), reverser and brake. • Brakes to tender are applied via brake lever. Alarm sounds if traction applied with brakes applied • TrueCharge meter (fitted behind fire box door) provides basic battery condition status but also acts a fault code indicator.
Mechanical Brakes	Brake on tender operated by electric actuator controlled by brake lever. Vacuum pump operated off of brake controls and plunger to release vacuum.

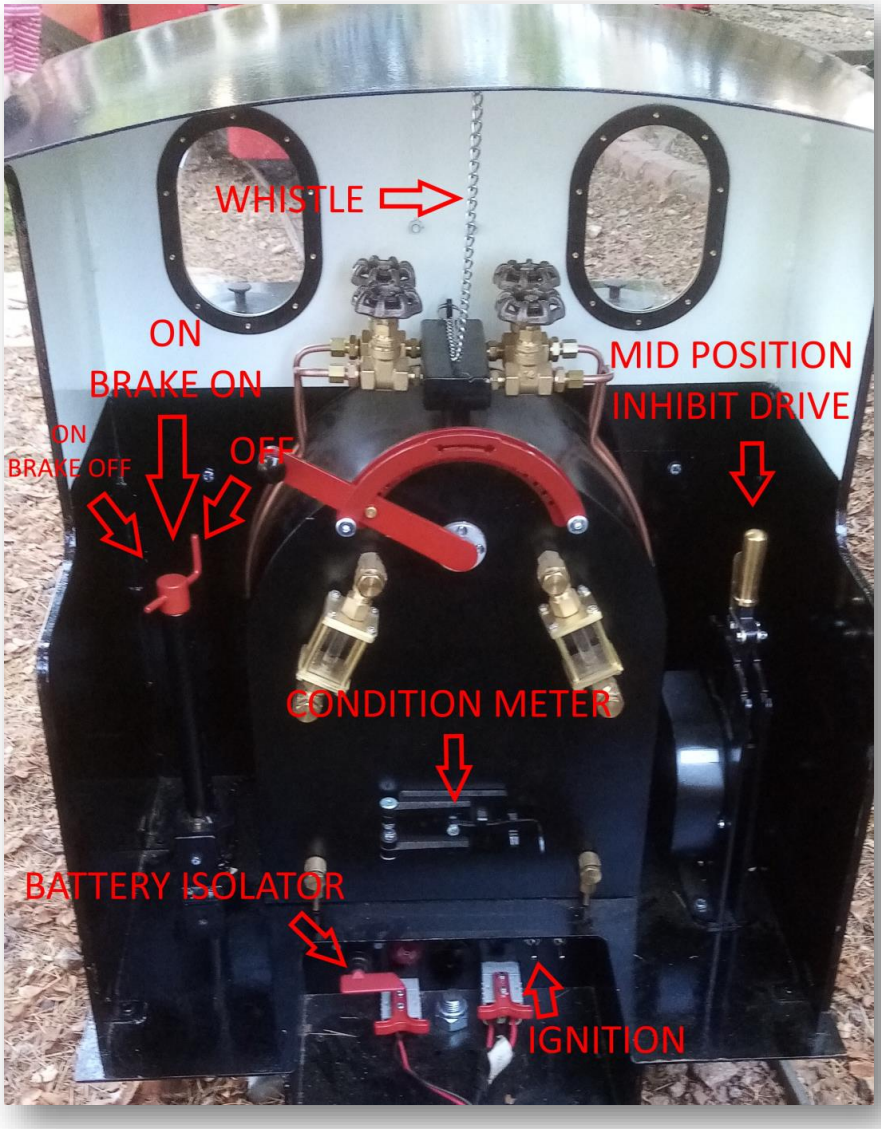
Materials

All parts of the chassis and body work are constructed from laser cut steel parts. Chassis' 5mm steel with additional stiffeners and cross supports. Deck to be 3mm steel with the body work being a combination of 2 and 3mm steel parts.

- Back head and steam fittings to be similar to those used on real steam engines.
- Name plates and makers plates cast brass.
- Water cut and polished 3mm brass spectacle surrounds to cab front holding 2mm glass.
- Brass chimney cap and steam dome.

Paint Finish

- Craft Master coach enamel to body panels
- Coloured panels are polymeric gloss vinyl
- Chassis spray painted acrylic paint
- Deck – spay painted acrylic and covered vinyl film.

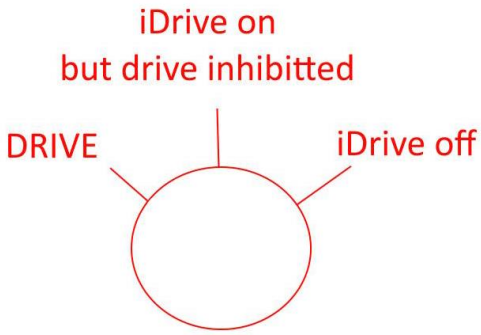


Running Notes

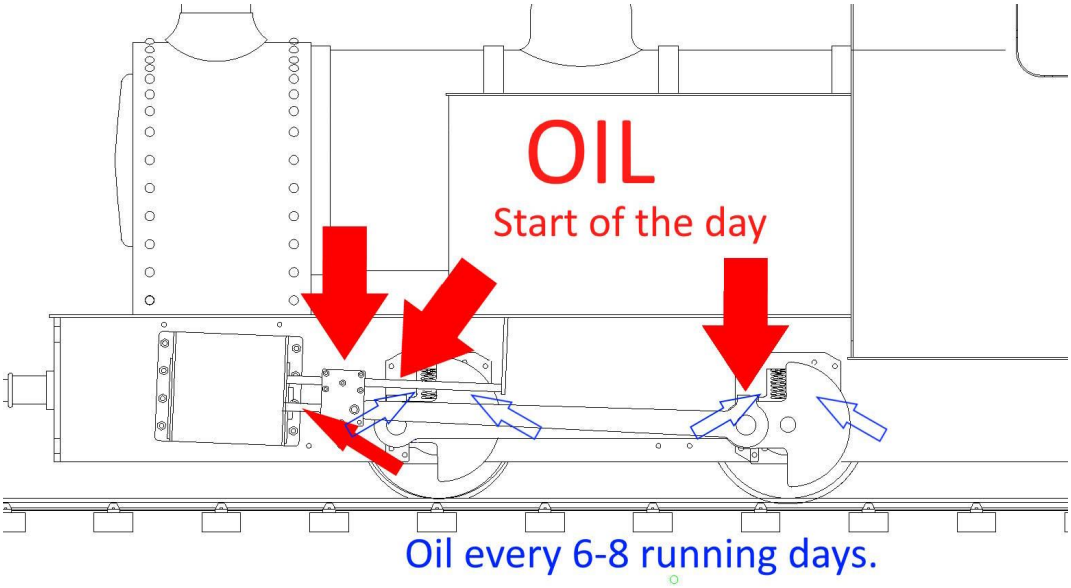
- Before running, -
  - Fill oil cups on coupling and conrods + cross head.
  - Make sure the charger is unplugged and the lead carefully tucked up inside the tender.
- If not already on, turn on the battery isolator switch.

- Ensure the regulator is at zero (fully anticlock), brake lever in off position and the reverser is in mid position.

- Turn the brake lever fully anti clockwise and reverser to full forward position.



- If the Truecharge meter strobes up and down it means it has inhibited drive as the regulator is not at zero. Returning to shut position should see this reset.
- There may be a delay when first switching on as the iDrive unit performs self-diagnostic checks – indicated by a pulsing red light for a second or two.
- If you are running with vacuum braked coaching stock switch wait until the vacuum pump stops continuous running.
- If an alarm sounds when applying power it means the brake is still on. Turn brake lever to left (anticlock).
- Slow acceleration and lower speeds will extend battery life.
- Earl locomotives appreciate applying power slowly to the motors and working up the regulator rather than applying full power straight away.



Regenerative Braking

- Regenerative braking is when the motors are used to generate electricity which is then put back in to the batteries. For short light weight trains the power saving advantage is minimal but having a loco which will bring a loaded train to a halt is a great advantage.
- The braking is so effective that on hard braking you may even get wheel slippage on the engine.
- Braking is progressive –

“the faster you shut the controller down the harder the braking will be”

- The controller also has an emergency stop feature which means at full shut down the controller will put power to the motors to achieve maximum braking. Try to avoid unless necessary.
- Aggressive braking will increase wear.

PLEASE NOTE

- The loco should never be left unattended unless it is turned off by brake lever and reverser in mid position.
- If left on and not used, the iDrive will go in to sleep mode after 20 minutes. To wake up turn brake lever to off position and on again.

FAULT FINDING

Symptom	Possible Causes
No Power – no lights on True Charge	○ Check batteries are charged ○ Check battery connections + isolator is in the correct position ○ Check all the battery leads, controller connections
True Charge meter lights up but no power to motors	○ Check wire connections to fire box controls – removed by taking out 5mm bolts to sides – see wiring diagram
TrueCharge meter just flashes	○ See fault code chart. Take note of the number of leds that are flashing. ○ Switch off by ignition switch for 30 seconds before switching on ○ If possible, rectify fault shown on chart
TrueCharge doesn't show green lights	○ The TrueCharge Meter reads the voltage from the batteries. Some batteries can give a slightly lower voltage and yet still provide the capacity required.
Engine seems to be losing power	○ Check to see if Truecharge Meter drops when power applied if yes - failing batteries ○ Grease on track. This will affect acceleration and regenerative braking. This is more common than you may think. Clean track and wheels to cure.
Strange whirring sounds coming from under loco	○ STOP IMMEDIATELY. Check for trapped debris ○ Oil all bearing rubbing surfaces
Acceleration and deceleration is "lumpy"	○ This could be a symptom of a faulty or failing potentiometer drivers handle. Replace the 5k linear potentiometer if in doubt. ○ Grease on the track – clean track
Electrical smell coming from the engine	○ Switch off the power immediately by the battery isolator switch. ○ Investigate using smell and touch for hot wires and components. Report back to RoR ○ The controller is rated for 180amp continuous running but has been restricted to 140amp. Do not over load the loco as it can result in damaging the motor wires and overheating of the motors. If in doubt check motor temperature regularly by reaching under the loco and feeling the motors.

Batteries

- Plug the charger in at any opportunity you can. Even on running days, plug it in when in the station area. Doing so will prolong the life of batteries and should see you get well in excess of 50 running days you may otherwise achieve.
- The loco has been fitted with a high quality 16amp charger. It is designed to charge the batteries and switch to top up mode once charged. There shouldn't be any issues with leaving the loco on charge full time. If the batteries are known to be fully charged then it can be unplugged and just topped up before running.
- Do not run the batteries below 50% capacity.



- The iDrive unit has been programmed to protect the batteries from being excessively drained. If it detects the voltage dropping below **20v** for more than **30** seconds it will inhibit drive and flash up 1 red led on the truecharge meter. Do not continue to use batteries which continually trips the unit out with low voltage.
- Single flashing LED can also indicate bad battery connection.
- Wet cell batteries should always have the lead plates covered in electrolyte. If exposed then top up with distilled/ deionised water. Only top up when fully charged. Low electrolyte can allow build-up of hydrogen gas and risk of explosion.

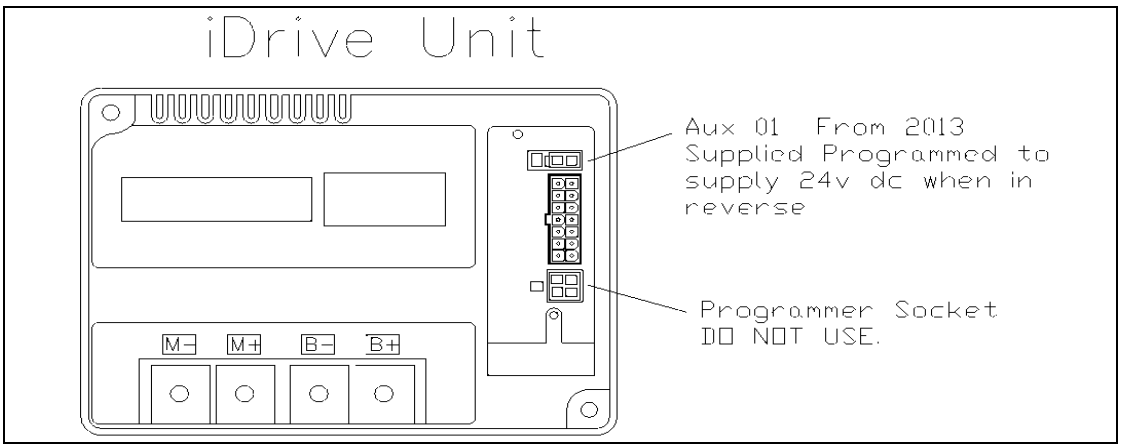
24 Volt Lead Acid Battery State of Charge	
Level	Voltage
100%	26.00 Volts
90%	25.55 Volts
80%	25.00 Volts
70%	24.60 Volts
60%	24.30 Volts
50%	24.10 Volts
40%	23.90 Volts
30%	23.62 Volts
20%	23.32 Volts
10%	23.02 Volts
0%	21.00 Volts

LEFT - Rough guide of the correlation between voltage and capacity. Settled voltage.

END OF LIFE

Anything after 50 full charge cycles is a bonus. If when put under load the voltage drops quickly but recovers when power stopped, it could be a sign the batteries are at the end of their life.

iDrive Unit (motor control unit)



The idrive unit has been programmed by Ride on Railways. The unit is factory sealed and contains no user serviceable parts. Do not open the unit as it will invalidate the manufacturer guarantee and may affect how the company deals with a repair.

The Truecharge Meter not only acts as a basic battery condition meter but a fault reporter. If the unit flashes up a code please use the chart below to identify the fault. If the unit is flashing and the engine does not power up, take note of the fault before switching off the ignition switch. If the unit fails to reset please contact Ride on Railways.

Do not worry if you do not get all the green lights lit up on the meter. Its meter is only a basic guide to battery condition and works on the assumption that when batteries are running low the voltage drops. Some batteries can give out a slightly lower voltage yet still have good capacity.

If in doubt check batteries with a load bank tester.

Truecharge Meter Readings



The meter can show potential issues through the battery condition meter. It does this by flipping in to fault reporting mode and flashing up a certain number of led's.

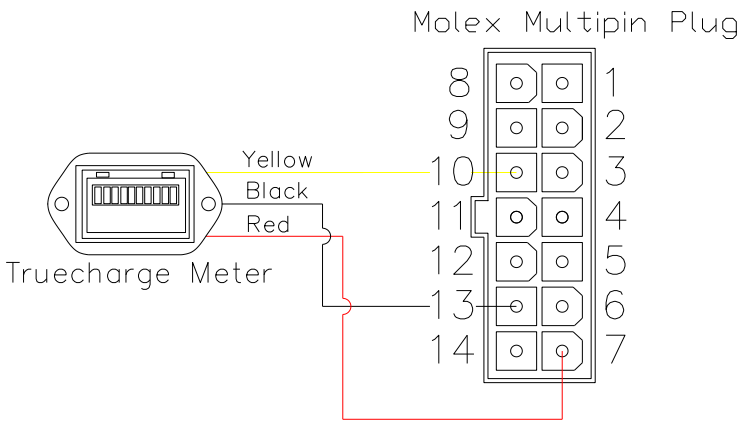
To switch back to battery condition switch the controller off and back on. If the fault flashes again further action should be taken to sort out the fault.

FLASHING LED CHART

1 Bar	The battery needs charging or there is a bad connection to the battery. Check the connections to the battery. If the connections are good, try charging the battery.
2 Bar	There is a bad connection to the motor. Check all connections between the motor and the controller.
3 Bar	The motor has a short circuit to a battery connection. Contact your service agent.
4 Bar	Not used.
5 Bar	Not used.
6 Bar	The controller is being inhibited from driving.
7 Bar	A throttle fault is indicated. Make sure that the throttle is in the rest position before switching on the machine.
8 Bar	A controller fault is indicated. Make sure that all connections are secure.
9 Bar	The parking brakes have a bad connection. Check the parking brake and motor connections. Make sure the controller connections are secure.
10 Bar	An excessive voltage has been applied to the controller. This is usually caused by a poor battery connection. Check the battery connections.

If the lights are lighting up and down in sequence it means the regulator is not in the shut position (safety lock out to avoid runaways). Return to shut position to start.

Truecharge Meter Wiring



Power Wiring – Battery and Motor

To follow

Maintenance and Servicing

- If the loco is to be pushed or towed please make sure the main battery isolator is switched on. Do not tow faster than 10mph otherwise the regenerative braking will kick in.
- Deep cycling leisure batteries will severely reduce the number of recharging cycles to be expected from the batteries.

Before Running

- Fill oil cups on coupling and conrods + cross head.
- Visually inspect for any loose parts of running gear
- Roll loco by hand with ignition off to ensure the loco freely runs.

Ever 6-8 running days

- Spray oil to the axle keeps where the take up bearings slide + the springs where they pass through the top of the housing.
- Roll engine by hand and listen for any irregular noises or lumpy rolling

Once a season

- Remove and check all battery terminals for scaling – clean is necessary

- Spray oil to the gaps to the sides of the central bearing housing in the UCT take up bearings
- Inspect wheel sets for damage and axle box grub screws are tight on to axle
- Visual check on all nut and bolts for missing or loose components.
- Physically check all cabling damage, fraying or signs of overheating.

As Required

- Touch up any chipped paint to avoid moisture ingression.
- Investigate any strange noises or electrical smells - if in doubt turn it off.

