Timpdon Electronics

AutoShuttle Model *SH3*

AutoShuttle Model ***SH3*** is an advanced microprocessor controlled bi-directional pulse width modulated model railway motor speed controller, designed specifically to provide continuous automatic shuttle operation between two terminus stations and optional intermediate halts, without operator intervention.

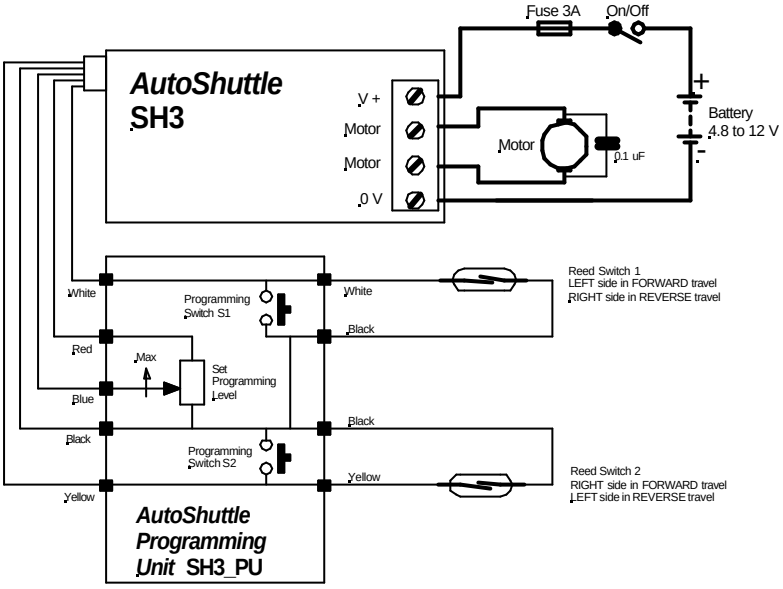
System control is via two vehicle mounted reed switches, operated by trackside magnets.

All operating parameters are user programmable.

Features

- Digital microprocessor controlled pulse width modulated motor speed controller, with built-in reverser.
- Small size – 70mm x 25mm x 15mm.
- 4.8 to 12 V d.c. - 2.5 A continuous motor load current.
- Internal reverser relay.
- Unlimited number of intermediate halts, in either direction.
- Independently user programmable for maximum speed, crawl speed, acceleration period, deceleration period, terminus wait time and intermediate halt wait time. All programmed parameters are retained when power is removed from the unit.
- Requires only two vehicle mounted reed switches and associated trackside magnets, for full operation.
- Supplied complete with programming unit, two fully wired reed switches and four trackside magnets.

Installation and Wiring



Notes

1 Connect the **V+** terminal to the **battery positive** and the **0V** terminal to the **battery negative**. Connect the two **motor** terminals to the motor. Keep the motor leads as short as possible and twist them together, to minimise electrical interference.

If, on testing, the direction of travel is opposite to that you expected, reverse the **motor** connections at the terminal block.

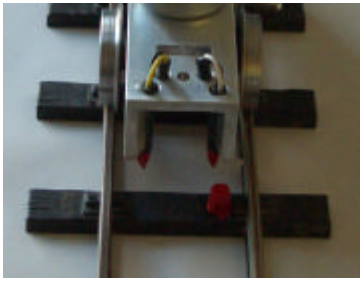
2 **Take care with the battery polarity**. The ***AutoShuttle*** is not protected against reverse supply polarity.

Reversed polarity will result in very high currents and may damage the ***AutoShuttle***. You are recommended to fit a 3A fuse in the positive battery lead for protection.

3 Fit an On/Off switch in the positive battery supply lead. The ***AutoShuttle*** will be in operation at all times when battery power is connected to it.

4 Connect the 0.1 µF suppressor capacitor supplied loose with the ***AutoShuttle*** directly across the motor terminals, to minimise electrical noise generated by the motor.

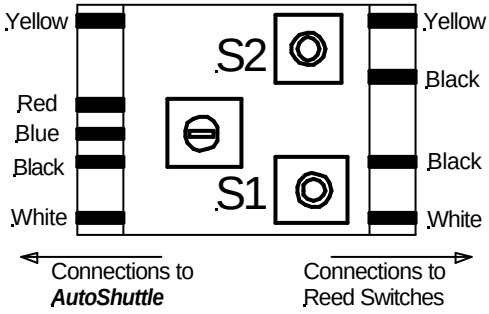
5 Mount the two track magnet sensing reed switches supplied one on each side of the vehicle where they will be activated by the track magnets. Refer to ***Timpdon Electronics*** **Technical Note 3 – Using Magnet Operated Reed Switches** for advice on mounting switches and magnets.



You must ensure that reed switches are positioned so that each switch can be activated only by its own track magnets, and not those associated with the other switch. See below for details of track magnet positioning.

Connect the reed switches, as shown in the **Installation and Wiring** diagram. Note that the **white** wire must be connected to the **left side** reed switch in **forward** running, and the **yellow** wire to the **right side** switch.

6 The programming unit is not required in normal running, only during programming of the ***AutoShuttle*** operating parameters which, once set correctly, should rarely need changing. You may, therefore, either build the programming unit into the vehicle, or connect it to the vehicle only when required, via a cable and a suitable plug and socket. If the programming unit is vehicle mounted, you may use it as a connection point for both the ***AutoShuttle*** unit and the reed switches. Connections to the programming unit are shown below.



Principles of Operation

Note *In the following paragraphs, references to **left** and **right** are relative to the current direction of travel of the vehicle.*

The ***AutoShuttle*** uses two vehicle mounted reed switches, actuated by two sets of track side magnets, to control operation. The positioning of the trackside magnets determines deceleration and stopping points and whether a stop is a **terminus**, where the subsequent direction of motion is reversed, or an **intermediate halt**, where the subsequent direction of motion is the same as before the stop.

When starting from rest after either a **terminus** or **intermediate halt** stop:

- The vehicle will accelerate at a controlled rate, determined by the ***acceleration period***, until the ***maximum speed*** is reached.
- It will then continue at ***maximum speed*** until a **stop request magnet** is detected.
- It will then decelerate at a controlled rate, determined by the ***deceleration period***, until it reaches the ***crawl speed***.
- It will then continue at ***crawl speed*** until a **stop point magnet** is reached.
- The vehicle will then stop and wait for either the ***terminus wait time*** or the ***intermediate halt wait time***, as appropriate.
- Then, if the stop is a **terminus**, the reverser will be switched.
- The vehicle will then restart.
- On power up in normal operation, the vehicle will start in forward travel as if it had just left an **intermediate halt**.

Values for ***maximum speed***, ***crawl speed***, ***acceleration period***, ***deceleration period***, ***terminus wait time*** and ***intermediate halt wait time*** are all individually user programmable. Programming procedures are described below.

The determination of a stop type, **terminus** or **intermediate halt**, depends on the positioning of track magnets associated with the stop.

Terminus

Requires two magnets:

Magnet 1	**Stop Request**	Positioned on **left** at point where deceleration is to start.
Magnet 2	**Stop Point and Terminus Indicator**	Positioned on **right** at point where vehicle is to stop.

Intermediate Halt

Requires 3 magnets:

Magnet 1	**Stop Request**	Positioned on **left** at point where deceleration is to start.
Magnet 2	**Intermediate Halt Indicator**	Positioned on **left** about 50 mm after Magnet 1. This magnet must be passed before the vehicle has decelerated to ***crawl speed***.
Magnet 3	**Stop Point**	Positioned on **left** at point where vehicle is to stop

Notes

1 See the **Operation Diagram** overleaf for more magnet positioning information.

2 You may have as many **intermediate halt** stops as you wish, in either direction. Three additional magnets will be needed for each such stop. ***Timpdon Electronics*** can supply packs of additional magnets. Stops in opposite directions may overlap.

3 An **intermediate halt indicator magnet** must be positioned between the **stop request magnet** and the point where the vehicle reaches ***crawl speed***, and at least 25 mm after the **stop request magnet**.

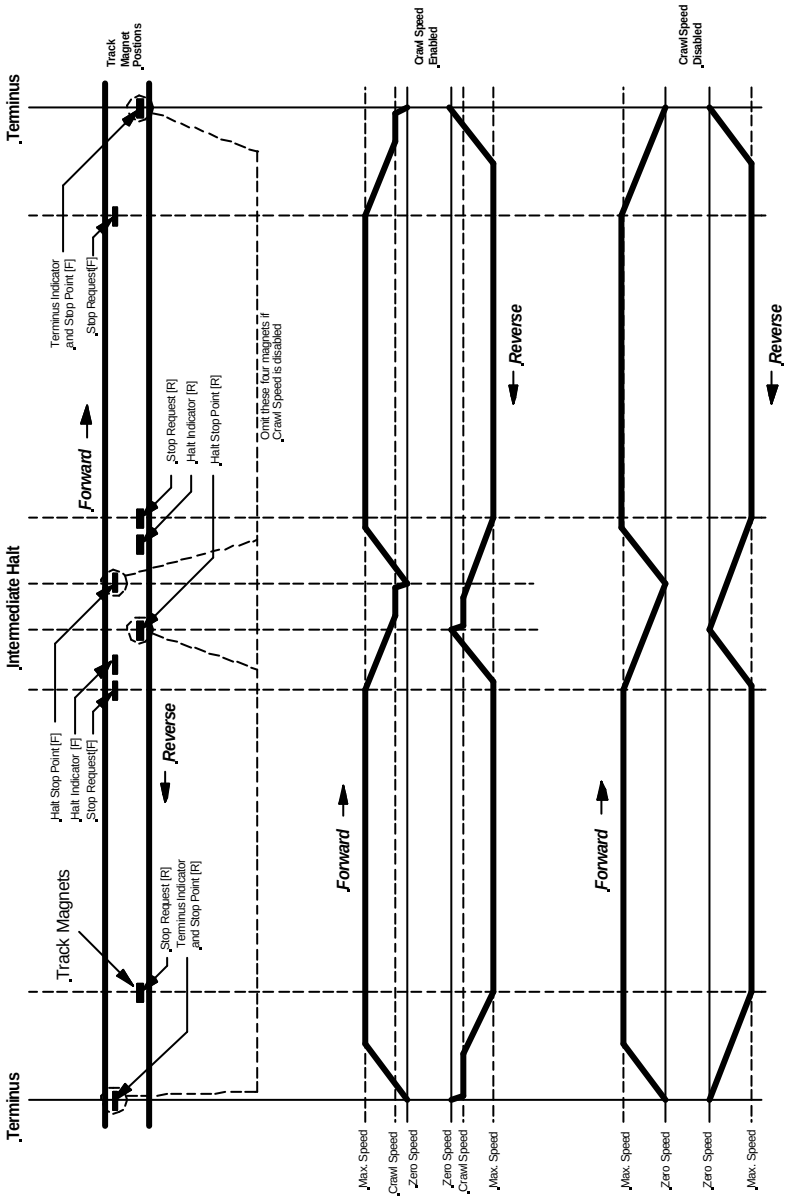
4 The vehicle **must** reach ***maximum speed*** before a **stop request magnet** will be detected.

5 You may need to experiment with the exact positioning of the **stop point magnet**, as the vehicle may continue to move under its own inertia after power has been removed from the motor.

6 If ***crawl speed*** is not required and exact **stop point** positioning is not critical, you may disable the ***crawl speed*** by programming its value to **zero** and omit all **stop point magnets**. The vehicle will then decelerate directly to a halt from the **stop request magnet**, over the programmed ***deceleration period***, and then proceed automatically as if the **stop point magnet** had been detected.

7 At 16 mm scale, the recommended spacing between **stop request** and **stop point** magnets is about 600 mm. This will permit realistic deceleration at scale speeds. You should aim to cover the last 100 mm at ***crawl speed***.

Operation Diagram



User Programmable Parameters

The ***AutoShuttle*** has six different user programmable operating parameters which may be individually set to suit the requirements of your layout. Once programmed, each parameter is stored in non-volatile memory within the ***AutoShuttle*** and is retained even when power is removed from the unit.

The value of each parameter is selected using a single setting potentiometer on the programming unit, and saved using the two programming switches, **S1** and **S2**, as described below. To determine the set value of each programmed value, you may either estimate the position of the setting potentiometer between zero and range maximum, or set the potentiometer to give the required output voltage using a suitable multimeter, measured between the **blue** and **black** wires at the programming unit. In all cases, a voltage of **zero** corresponds to a **zero setting value** and a voltage of **5.0 V** corresponds to the **range maximum setting value**.

In addition, for ***maximum speed*** and ***crawl speed*** parameters, you may use the **Test Vehicle Speed** programming option [**Setting 7**] to determine the required settings under actual running conditions, as described below.

The available programmable settings are:

Setting	Parameter	
1	**Maximum Speed**	
	Range:	0 to 100% of battery voltage.
2	**Crawl Speed**	
	Range	0 to 100% of battery voltage.
3	**Acceleration Period**	
	Range:	0 to 25 seconds from zero to 100% of battery voltage. Note that if the ***maximum speed*** is set to less than 100% of battery voltage, the actual ***acceleration period*** will be correspondingly reduced.

Setting **Parameter**

4 **Deceleration Period**

Range: 0 to 25 seconds from 100% of battery voltage to zero.

Note that if the ***maximum speed*** is set to less than 100% of battery voltage, the actual ***deceleration period*** will be correspondingly reduced.

5 **Terminus Wait Period**

Range: 0 to 25 seconds.

6 **Intermediate Halt Wait Period**

Range: 0 to 25 seconds.

In addition, there are two extra programming options not associated with individual program settings. Both are described in more detail below:

7 **Test Vehicle Speed**

8 **Restore Factory Defaults**

To Program Operating Parameters

In order to change any programmable parameters, you must first enter programming mode, as described below. Once in programming mode, normal operation can only be restored by switching power to the ***AutoShuttle*** **off** and then **on** again.

To enter programming mode:

1. Ensure that power is removed from the ***AutoShuttle***.
2. Press and hold **both** switches **S1** and **S2** on the programming unit.
3. While the switches are pressed, apply power to the ***AutoShuttle***.
4. Then release switches **S1** and **S2**.

Programming Procedure

To change any programmable parameter:

1 First make sure you are in programming mode.

2 Set the potentiometer on the programming unit to the required value of the parameter you wish to change.

3 Press and hold switch **S1** on the programming unit.

4 With **S1** pressed, press and release switch **S2** the number of times corresponding to the setting number of the parameter to be changed, as listed above.

For example, to program the **deceleration period**, press and release **S2 four** times.

5 Then release **S1**. The new setting will be saved.

6 Repeat steps **2** to **5** as required for other parameters.

Notes

1 You are recommended to program operating parameters in the order shown above, starting with ***maximum speed*** and ***crawl speed*** settings.

2 Ensure that the ***crawl speed*** setting you program is high enough to ensure that the vehicle will continue moving until it reaches a **stop point** magnet.

Remember that, as battery capacity is used, its voltage will fall and reduce the ***crawl speed*** slightly.

If the vehicle can not reach a **stop point** magnet under ***crawl speed***, system operation will fail.

3 Final settings for ***acceleration period*** and ***deceleration period*** are best determined by experiment to give suit your particular layout.

Test Vehicle Speed

To determine vehicle **maximum speed** and **crawl speed** settings, you may use the **Test Vehicle Speed** programming function, by pressing switch **S2 seven** times during the ***Programming Procedure*** described above.

This setting differs from other programming options in that, instead of saving the programming potentiometer setting, it immediately powers the vehicle in a **forward** direction at the **current potentiometer setting**, until cancelled. You can therefore run the vehicle on the track and adjust the speed to the actual required value.

When the required speed has been set, press **both switches S1 and S2 together** to cancel ***Test Vehicle Speed*** and return to normal programming operation. The selected speed can then be immediately programmed for either **maximum speed** or **crawl speed** setting, as appropriate.

Restore Factory Default Settings

The ***AutoShuttle*** is supplied with the following factory default settings loaded for each of the programmable parameters:

Maximum Speed	50% of battery voltage
Crawl Speed	20% of battery voltage
Acceleration Period	10 seconds, corresponding to 5 seconds from zero to maximum speed [50% BV]
Deceleration Period	7 seconds, corresponding to 2.1 seconds from maximum speed [50% BV] to crawl speed [20% BV]
Terminus Wait Period	15 seconds
Intermediate Halt Wait Period	8 seconds

To restore these factory default settings at any time you may use the **Restore Factory Defaults** programming function, by pressing switch **S2 eight** times during the ***Programming Procedure*** described above.

All six programmable parameters will be restored to the factory default values above, over-writing their existing values.

User Notes

Timpdon Electronics has a continuing program of product development and improvement.

We reserve the right to make improvements to the hardware specification and microcontroller software control program of this product, without notice. All recent ***Timpdon Electronics*** products can be factory upgraded to the latest software issue. Contact ***Timpdon Electronics*** for details and prices of available upgrades.

AutoShuttle Spare Part and Accessories

The following spare parts and accessories for your ***AutoShuttle*** are available from ***Timpdon Electronics***:

Order Code	Description
SH3_PU	Spare ***AutoShuttle*** Programming Unit.
SH3_R2	Pack of two fully wired reed switches.
SH3_M3	Pack of three trackside magnets. One complete pack is required for each intermediate halt.

Timpdon Electronics also manufactures a wide range of electronic speed controllers, horns, lighting units, radio control interfaces and other microprocessor controlled electronic accessories for railway and marine modellers.

Contact ***Timpdon Electronics***, or visit our web site, www.timpdon.co.uk for more details.