Traverser

This device controls DC power to a track enabling a train to automatically traverse back and forth, with a stop at each end with a configurable duration.

The device requires four position sensors or track occupancy detectors to provide active-low inputs for train location. The Quad Occupancy Detector from Circuits4Tracks is ideally suited to this application.

Electrical Specifications

Power input requirements	12 volts AC, up to 1 ampere Voltage range: 10 to 14 VAC
Output track current maximum *Will be lower if supply has lower current output*	1 ampere
Maximum track voltage range	6.5 to 11.0 volts *(no load voltage)*
Power connectors	Screw terminals: 2 for power input 2 for track output
Screw terminal minimum wire gauge	22
Screw terminal maximum wire gauge	14
Position/detector inputs	6-pin SIP End pins provide 5 volt power 4 centre pins active-low inputs

Traverser Power Connections

The Traverser must be powered from a 12 volt alternating current power source capable of providing up to 1 amp of current. Alternating current is needed as the Traverser uses an AC bias current for detecting occupancy when the DC track power is zero. The Traverser will operate with either 50 Hz or 60 Hz alternating current.

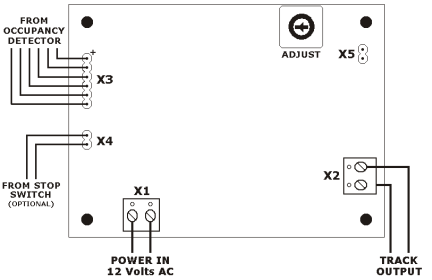

Figure 1

The 12 volt AC power source is connected to the Traverser using the screw terminals on the green terminal block, labelled **X1** in Figure 1 and on the board.

The screw terminals of the black terminal block, labelled **X2** in Figure 1 and on the board, provide the track output. Think of this output just like the output of any cab power pack. When using current-sensing occupancy detection, the preferred method for The Traverser, the power to the track must pass through the detectors on its way to the track. If common rail wiring is used, one terminal connects directly to the track, and the other via the detector. See Figure 2.

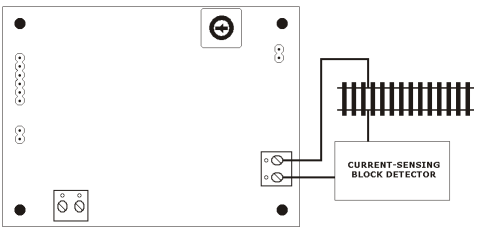

Figure 2

The Traverser requires four blocks to be detected: two at each end of the track. The track may be divided into more blocks, but only these four are needed.

Connecting The Traverser to a Quad Occupancy Detector

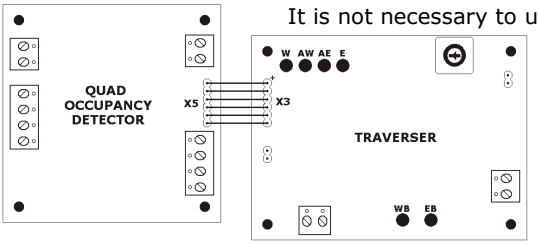

Figure 3

It is not necessary to use our Quad Occupancy Detector, but The Traverser is designed for easy use with one. The detection input header, labelled **X3** in Figure 3 and on the board, is identical to the output header on the Quad Occupancy Detector, labelled **X5** in Figure 3 and on the detector. The Traverser supplies 5 volt DC power to the detector on pins 1 and 6.

The detection information is on pins 2 to 5, corresponding to blocks 1 to 4 on the detector. The Traverser's block indication LEDs are labelled to show pin 2 (block 1) as **West** (**W** in Figure 3), pin 3 (block 2) as **Approach West** (**AW** in Figure 3), pin 4 (block 3) as **Approach East** (**AE** in Figure 3), and pin 5 (block 4) as **East** (**E** in Figure 3).

Connecting The Traverser to other Occupancy Detectors

The Traverser may be used with any occupancy detector circuit that provides an active low output. This means that when occupancy is detected, the detector's output is connected to ground, or is pulled down to 0.8 volts or less. This can be done using a relay contact, an open-collector output from a transistor, or from logic gates of a digital circuit or an output port from a computer or microcontroller. When grounded, each input on The Traverser will source about 2.2 mA.

It is highly recommended that occupancy detection used with The Traverser be able to detect an entire block, and not just a single point. This generally means using a current-sensing method of detection and not a single point-detector that photo-detection provides.

Point-detection can only detect occupancy as something passes it. The Traverser needs to know the location of a train at start up and a train that is not at the point-detector's location will not be detected. This can result in wrong-direction operation at start up, or failure to properly stop and reverse at an end block.

Operation

Figure 4

The Traverser has an optional STOP header (labelled **X4** in Figure 1 and on the board). If used, this may be connected to a switch that will permit holding the train in its initial position, or at either end of the line once it is operating. The two pins of the header is simply shorted when the stop function is to be used. When connected to a switch or contacts, polarity is unimportant. If an electronic means will be used (e.g.: an open-collector transistor output), the pin closest to the **X4** label is ground and the other pin is grounded to hold the train.

When the Traverser is powered up and the STOP header is not shorted, operation will begin after a one second pause. The initial direction will be eastbound unless the east end block is occupied, then it will be westbound. When the green direction indicator LED comes on (**WB** or **EB** in Figure 3), track voltage will begin to rise and cause the train to accelerate in the initial direction. Since most motors have a minimum starting

voltage, there will likely be a brief pause after the direction LED lights before the train begins to move.

When the block at the other end of the line becomes occupied, after its approach block has become occupied, track voltage will begin to decrease to zero. When the voltage reaches zero, the direction LED will shut off. Since most motors stop moving at some minimum voltage, there will likely be a pause from when the train stops and the direction LED shuts off.

If the STOP header is not shorted, the train will remain stopped, with neither direction LED lit, for the end-of-line delay period. By default, this period is two seconds but may be changed following the instructions in the section "Configuring the End-of-Line Delay". At the end of the delay period, the other direction LED will light and track voltage will begin increasing with the polarity to operate the train in the opposite direction.

On startup, if the STOP header is shorted, the East block LED indicator will flash to indicate the configured end-of-line delay time in seconds: Short flashes for digits 1 to 9, and long flashes for zero. For example, if the delay is configured for 120 seconds the flash sequence will be:

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Configuring the End-of-Line Delay

The Traverser is initially configured to provide a two-second delay at each end of the line. This delay can be changed to one of sixteen different durations using the procedure described here. In order to perform the procedure, the four detection inputs are used to select one of sixteen choices. One way to do this would be to disconnect the occupancy detector replace them with four switches to manually connect each input to ground.

Alternatively, the track itself could be used by placing (or removing) a separate DC locomotive in each block. Instead of a locomotive for each block, you can use a 1 kΩ resistor (¼ watt or greater) for each block that can be clipped to the rails.

1. Shut off power to the Traverser.
2. If not using locomotives or resistors on the track, replace the position/occupancy inputs with something that will allow manually changing which inputs are grounded.
3. Place a jumper on the CONFIG header (X5).
4. Power up the Traverser. If the Traverser sees that the CONFIG header has a jumper, it will sequence through each of the four block indicator LEDs twice, then they will shut off briefly before they will light to indicate which of the position/occupancy inputs are grounded (occupied).
5. Set the position/occupancy inputs, or occupy/unoccupy each block to correspond to the pattern for the desired delay time (see table on next page). LED corresponding to input will light when the input is grounded.
6. When the desired pattern is selected on the position/occupancy inputs, remove the jumper on the CONFIG header.
7. All indicator LEDs will shut off briefly and the East block LED indicator will flash to confirm the configured time in seconds: Short flashes for digits 1 to 9, and long flashes for zero. For example, configuring for a 120 second delay will give the flash sequence:

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8. Shut off power to the Traverser and reconnect the normal position/occupancy inputs.
9. Traverser will now use the new delay time at each end of the line.

Delay Time Configuration				
WEST	APPROACH WEST	APPROACH EAST	EAST	DELAY TIME
off	off	off	off	2 seconds
on	off	off	off	5 seconds
off	on	off	off	10 seconds
on	on	off	off	15 seconds
off	off	on	off	20 seconds
on	off	on	off	30 seconds
off	on	on	off	45 seconds
on	on	on	off	1 minute (60 seconds)
off	off	off	on	1¼ minutes (75 seconds)
on	off	off	on	1½ minutes (90 seconds)
on	on	off	off	2 minutes (120 seconds)
on	on	off	on	2½ minutes (150 seconds)
off	off	on	on	3 minutes (180 seconds)
on	off	on	on	3½ minutes (210 seconds)
off	on	on	on	4 minutes (240 seconds)
on	on	on	on	4¼ minutes (255 seconds)

Adjusting Maximum Voltage (Speed)

The maximum voltage applied to the track, and therefore the maximum speed of the train, may be adjusted from a low end of about 6.5 volts to a high end of about 11.0 volts (measured with no load). The trim pot on the board, labelled **ADJUST** in Figure 1, is used to make this adjustment. Turn counter-clockwise to lower the voltage and clockwise to increase.

Figure 5

Warranty

A factory-assembled Traverser is tested and warranted against manufacturing defects for a period of 1 year from date of purchase. As the circumstances under which The Traverser is installed cannot be controlled, failure of The Traverser due to installation problems cannot be warranted. This includes misuse, miswiring, operation under loads beyond its specifications, or short circuits. The warranty is voided if The Traverser is connected to a power supply exceeding 14 volts AC.

If The Traverser fails for non-warranted reasons, it can be replaced with no questions asked for the cost of $29 plus shipping (this fee subject to change).

Send an email to **circuits@daxack.ca** for information on warranty or non-warranty replacement.

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