

CONGRATULATIONS !

The **SMAIL™** **S**LOW **M**OTION **A**CTUATOR WITH **I**NTEGRATED **L**OGIC represents the very latest in high technology **DCC** design with an **INTERNAL** microprocessor/decoder controlling the proven **TORTOISE™** Slow Motion, stall motor gear-drive mechanism. The **SMAIL™** is a complete solution to all your automatic and **DCC** cab-controlled turnout operations. The **SMAIL™** may also be used in **DCC** or standard DC mode for crossing gates, 3 position semaphores and many other motion accessories. In DC mode, it is compatible with Circuitron and most other detection circuits. The fully enclosed construction with our ultra-simple mounting and linkage (included) make for a quick installation.

CONTENTS OF BOX:

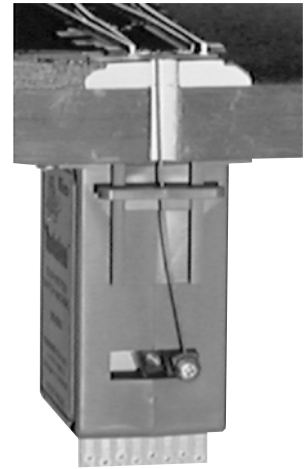
- (1) **SMAIL™**
- (1) Molded Fulcrum
- (1) 3.5" Spring Wire
- (1) 3/8" x #4 Phillips Retaining Screw
- (6) Pages Instructions



Please Read These Instructions Completely Before Attempting Installation, Wiring and Programming.

GETTING TO KNOW YOUR SMAIL™

The **SMAIL™** is controlled by internal electronics manufactured by NCE Corporation. Utilizing an enhanced version of their proven Switch-It™ Stationary Decoder technology, the **SMAIL™** is fully compatible with *any* **DCC** system that can provide accessory address control and/or signal control in either **NMRA** or **Digitrax** signal modes. The **SMAIL™** can be used as a **DCC** Slow Motion Switch Machine in any scale and with all **DCC** system voltages. A simple programming procedure sets the address and advanced users have the ability to program individual CV's (configuration variables). The **SMAIL™** can be easily configured to provide non-derailing action with detection circuits or with our **AUTO-ALIGN™** feature and can even do so on **AC** or **DC** powered layouts when powered by a separate **DC** source. For crossing gates, semaphore signals and other animation, the **SMAIL™** can be powered by the **DCC** system or a conventional **DC** power source of 8-18 volts. When used with detection circuits that provide a ground signal [-] on their outputs (Circuitron and most others) the **SMAIL™** does not require any additional driver circuitry. Two Control Terminals are provided that will override **DCC** commands and permit manual operation of the **SMAIL™** from a control panel. Industry standard terminal blocks or edge connectors can be fitted to the circuit board. The **SMAIL™** has two sets of internal **SPDT** switches for powering the frog, signals or panel lights. Mounting, mechanical options and specifications are all the same as the **TORTOISE™** and the **SMAIL™** can be used with Circuitron's Remote Mount (800-6100) and Remote Signal Activator (800-8100).



TORTOISE™ Photo Showing Mounting and Linkage

HOW TO MAKE ELECTRICAL CONNECTIONS TO YOUR SMAIL™



Figure 1

board as shown in the photo in Figure 1. Clip off any excess wire to prevent short circuits.

Many modelers find it easier to connect wires to the **SMAIL™** before mounting. Connections to the **SMAIL™** may be made by inserting light gauge (22-24 ga.) wires through the holes in the printed circuit board. It is also acceptable to just lay a stripped and tinned wire end on the edge connector pad and then "tack" solder it to the surface. We find that a short (15"-18") "whip" of CAT-5 or 6 network cable (available at home centers for a reasonable price) works well to make all 8 connections to the board and can then be connected to a terminal strip under the layout. Any wiring changes necessary can be made at the terminal strip rather than on the **SMAIL™** circuit board.

Some models of **SMAILS™** come factory equipped with screw type terminal blocks and the same blocks may be purchased as a set from Circuitron for user installation (part number 800-6301 pkg. of 1, 800-6306 pkg. of 6, 800-6312 pkg. of 12). Solder the wires (or terminal blocks) to the pads using rosin core 60% tin, 40% lead solder (available from Radio Shack) and a small 25 - 35 watt pencil-type soldering iron. **WARNING: DO NOT USE A HIGH WATTAGE SOLDERING GUN. DAMAGE TO THE PRINTED CIRCUIT BOARD IS NOT COVERED UNDER WARRANTY.** Wires may be inserted from either side of the board, but if mounting terminal blocks, *be sure to place them on the correct side of the*

Another option is to utilize an 8 or 10 position printed circuit board edge connector (available from electronics' distributors and from some on-line model railroad suppliers-(Download Application Note **AN-6000-04** for ordering information from one mail-order distributor) which will simply plug onto the **SMAIL™** circuit board. We do not recommend this method because of the chance of shorting adjoining pads.

MOUNTING THE SMAIL™ FOR USE AS A SWITCH MACHINE

THE **SMAIL™** REQUIRES ABOUT 3 1/2" OF CLEARANCE UNDER THE SUB-ROADBED MOUNTING SURFACE. IN SITUATIONS WHERE CLEARANCE IS NOT ADEQUATE, USE OF THE CIRCUITRON REMOTE MOUNT (800-6100) MAY SOLVE THE PROBLEM. IN THIS CASE, FOLLOW THE REMOTE MOUNT INSTRUCTIONS.

NOTE: YOU MAY FIND IT EASIER TO PROGRAM THE DECODER BEFORE MOUNTING THE MACHINE. SEE BELOW.

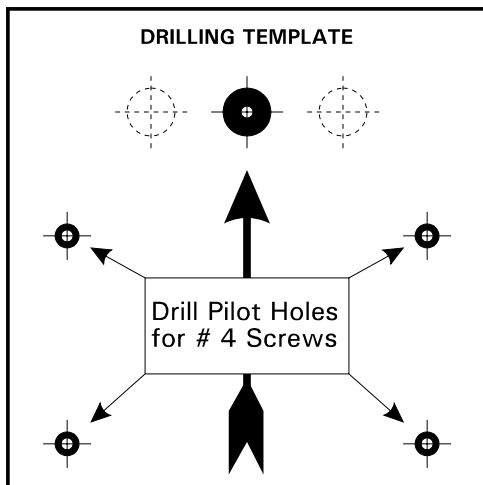
LAYOUT PREPARATION

The **SMAIL™** is designed to mount under the layout with the spring wire transmitting the side to side linear motion through the layout board and roadbed to the turnout throwbar. Turnouts should be checked for free movement of the points and a clear area under the layout for mounting the machine. Although the **SMAIL™** is extremely forgiving in mounting, a turnout that binds will still not switch smoothly. It will be necessary to provide an actuating hole or slot directly below a rivet or molded hole in the throwbar. This hole is typically located between the rails, but may be outside the rails, if desired. The size of this hole should equal approximately *twice* the total turnout point throw (1/4" works well for HO and S scales). If no throwbar hole is factory provided, a small hole may need to be drilled in the throwbar for the spring wire to pass through. If the turnout is already mounted, we suggest drilling a small (.032" - .040") pilot hole through the actuating hole in the throwbar and down through the roadbed and baseboard. Next, determine the total thickness of the roadbed and board and mark a 1/4" bit with tape or use a drill stop. Use of a "Forstner" style bit is the best choice because it cuts a flat bottom hole. Then, using the pilot hole as a guide, drill **UP** through the base and roadbed, being extremely careful not to break through and destroy the throwbar. It may be possible to flex the throwbar away from the roadbed slightly to help prevent this. Finally, use a hobby knife to remove any remaining wood and roadbed and to clean up the hole.

SMAIL™ PREPARATION

The 3.5" x .025" spring wire provided with the SMAIL™ is suitable for N and HO layouts having a total roadbed/baseboard thickness of one inch or less. If your layout thickness is greater than 1", you will have to substitute a suitable length of .025" spring wire for the one provided. If greater tension on the points is desired (for O Scale and larger and for layouts with a mounting depth exceeding 2 inches), you will want to substitute a heavier gauge wire such as .032" or .039". The output arm will have to be drilled out with a suitable diameter bit held in a pin vise. **CAUTION: DO NOT USE A POWER DRILL and only drill 3/16" deep!** Spring Wire (aka Music Wire or Piano Wire) is available in many gauges from the Special Shapes division of K & S Engineering—www.SpecialShapes.com and from many larger hobby shops under the K & S brand.

1. Prepare the spring wire by gripping it with pliers 1/8" from one end and make a sharp 75-80 degree (nearly right angle) bend. At a point 3/4" away from the initial bend, make an additional 15 degree bend in line with the first. Figure 2 is full size and may be used as a guide.
2. Using a NEW or NON-WORN #1 Phillips screwdriver, carefully thread the small phillips truss head retaining screw into the large hole in the throwarm. **DO NOT PUSH ANY HARDER THAN NECESSARY ON THE ARM!** After the screw bottoms out, remove it for the time being.
3. Slide the fulcrum into the fulcrum rails on the front face of the SMAIL™ so that the larger openings of the tapered pivot holes face the bottom of the machine where the circuit board exits the case. Slide the fulcrum to the very top of the machine to start.



FINAL MOUNTING

Cut out the DRILLING TEMPLATE and use a punch or hobby knife to cut out the large black dot. Leave the crosshairs. The SMAIL™ can be mounted off centerline if necessary for special clearance applications. *Request Application Note AN-6000-01.* Tape the template to the underside of the layout with the hole you just made carefully centered over the 1/4" access hole previously bored through the layout.

NOTE: THE LARGE ARROW SHOULD BE PARALLEL TO THE RAILS.

Drill pilot holes for #4 wood or sheet metal screws at the four points indicated (3/32" or #42 drill bit). Remove the template. CAREFULLY move the throwarm to the center of its motion by applying gentle side force. **DO NOT PUSH TOO HARD OR FAST OR YOU MAY DAMAGE THE GEAR TRAIN, MOTOR OR ELECTRONICS.** Place the long end of the pre-formed wire through the hole in the fulcrum and engage the short stub into the hole in the arm. It should be straight up and down with respect to the SMAIL™ case. Re-thread the retaining screw into the arm and tighten it down until the underside of the head is just barely touching the wire. **DO NOT OVERTIGHTEN!** You do not want to bind the wire. The purpose of the screw is just to keep the wire from popping out of the hole. Block your switch points at the center of their throw using strip-wood, plastic or toothpicks. From underneath, thread the wire up

FIGURE 2

through the access hole and through the hole in the throwbar. Move the SMAIL™ slightly from side to side until you can see that there is no tension on the wire and that it is perfectly vertical through the hole and throwbar. Your #4 pilot holes should be in the center of the SMAIL™ flange slots. Fasten the SMAIL™ in place with #4 x 1/2" pan head wood or sheet metal screws.

TEST THE OPERATION

Test operation using a 9-12 volt DC source such as a 9 volt battery connected to Terminals 1 and 8. Make sure the SMAIL™ runs fully to its stop against the case and that the points are held snugly against the stock rail with a little spring tension. With power still applied to 1 and 8, momentarily touch C1 or C2 to GND (*see figure 4*) and check operation to the other position. If tension on the points appears to be unequal in the two directions, loosen the mounting screws and move the SMAIL™ a small bit to equalize. If tension is inadequate against BOTH rails, move the fulcrum down just a bit to increase the throw. If the points move erratically or stick in either position, try lubricating all moving turnout parts with powdered graphite or teflon. **DO NOT USE OILS OR GREASE OF ANY TYPE!**

If your points still "stick" after lubricating, you may need to substitute a heavier gauge spring wire.

After testing the operation, trim the excess wire off above the throwbar with an abrasive cutoff wheel mounted in a Dremel™ or equivalent motor tool. **CAUTION: Do not attempt to use lightweight or precision wire cutters to cut the wire. The hardened spring wire will destroy them.**

ALTERNATE METHOD: Use the template as above, but instead of drilling pilot holes, merely mark their location with a punch or nail. Remove the template and sand the wood lightly to provide a clean surface. Spray the area with lacquer to seal the wood. Let dry overnight. Apply double faced foam tape (available at hardware stores) to the entire top surface of the SMAIL™. Remove the backing from the tape, and using the punch marks as locating guides, press the SMAIL™ into position. Rock the SMAIL™ in all directions to ensure a good bond. Finally, run a bead of silicone RTV (bathtub caulk) around the two mounting flanges against the layout. Allow to cure overnight before proceeding. **CAUTION: ALTHOUGH THIS METHOD PROVIDES ADDITIONAL SOUND DEADENING, THE LONGEVITY OF THE TAPE/SILICONE BOND IS LARGELY UNTESTED, AND LONG-TERM SATISFACTORY RESULTS ARE NOT GUARANTEED.**

MOUNTING THE SMAIL™ FOR USE AS A CROSSING GATE or SEMAPHORE ACTUATOR

Crossing gates and Semaphore signals in all scales can be effectively actuated by the SMAIL™. Methods will vary depending upon the brand and design of the device and the electronics used to control them. In most cases, the easiest way to accomplish this will be to use one of Circuitron's Remote Signal Activator Kits (800-8100). Follow the instructions packaged with the kit.

CONNECTING THE SMAIL™ TO YOUR SYSTEM

The main connections on the circuit board are numbered 1 - 8 from left to right as you face the front of the SMAIL™ - see Figure 3. Connections 1 and 8 feed the internal DCC decoder and electronics which drive the motor and will be powered by your DCC booster or from a DC power source of 8-18 volts if you are using the SMAIL™ manually or with detection for crossing gate or semaphore applications.

FOR DCC APPLICATIONS

On most DCC layouts, the easy way to connect the SMAIL™ to your DCC system is to simply connect terminals 1 & 8 to the track feeds or the DCC power bus in the vicinity of the turnout. The low current draw of the SMAIL™ (16— 20 ma.) will not place a heavy load on your booster, even with dozens of SMAILS™ connected. However, if your layout has a tendency for derailments at turnouts that cause booster shutdown or if you have a tendency to run into closed turnouts *causing* booster shutdown, you may want to consider using a separate small booster just for your SMAILS™. Although this requires a separate pair of bus wires to be run around the layout, it provides the advantage that the SMAILS™ will still operate even if a derailed or shorted train has shut down the track booster in the area. If a short circuit shutdown has occurred because you ran a closed turnout, you will still be able to re-align the turnout and clear the short easily. A small, 3 amp utility booster should power up to 150 SMAILS™. **CAUTION:** *If you want to use the AUTO-ALIGN™ feature of the SMAIL™ for non-derailing protection of turnouts AND you are using a separate switch machine booster, the SMAIL™ booster MUST be chassis grounded to the track power booster.* Download Application Note **AN-6200-01** from our website for more information.

FOR DC CROSSING GATE, SIGNAL AND ANIMATION APPLICATIONS

The SMAIL™ is designed to work with Circuitron and most other brands of model railroad detection. No additional driver circuits will be necessary. The outputs on the detectors must provide a connection to GROUND [-] when their output is on. The SMAIL™ terminals 1 and 8 should be connected to the same DC power supply that is powering the detection and other signal logic. The supply voltage to the SMAIL™ can be from 8—18 volts DC and polarity does not matter. The speed of the motor WILL depend upon the supply voltage and for crossing gate applications, it may be desirable to slow the SMAIL™ down somewhat. This voltage reduction can be most easily accomplished by simply wiring a number of silicon diodes (1 amp, 1N4001 style available from Circuitron and Radio Shack) in series with one of the input terminals. Each series connected diode will reduce the voltage by 0.7 volts, thus 4 diodes in series will give you about a 3 volt reduction. Zener diodes can be used for greater voltage reduction. Download Application Note **AN-6200-02** from our website for more details.

USING THE INTERNAL AUXILIARY SWITCHES

Connections 2, 3 and 4 connect to one of the internal SPDT auxiliary switches which may be used to power the turnout frog, signals, panel lamps, etc. In similar fashion, 5, 6 and 7 make up the other SPDT switch. These auxiliary switches are completely independent of the motor electronics and can switch a maximum of two (2) amps of current (they can safely carry 5 amps on each contact set) and they can switch AC or DC loads. If you need to switch heavier currents, parallel both sets of contacts or you may control a relay with them. Figure 3 shows the internal connections and switch configuration of the SMAIL™. Download Application Note **AN-6000-02** from our website for detailed wiring diagrams of turnout frog, relay and signal wiring using the internal SPDT switches.

USING THE CONTROL TERMINALS

The Control Terminals, C1, C2 and the internal Ground connection GND are used to connect to panel switches, detection circuits and other electronics to control the current position status of the SMAIL™. These terminals will be used in the following situations:

- 1) If you desire manual panel control of a SMAIL™ *in addition to* the DCC cab control.
- 2) If you would like to control your SMAIL™ from multiple panel locations.
- 3) If you would like to use a diode matrix to control multiple SMAILS™ from one pushbutton.

Download Application Note AN-6200-03 for details on diode matrix control of the SMAILS.

- 4) If you would like to automatically operate turnouts using detection circuits.
 - 5) If you will be using your SMAIL™ for grade crossing gates or semaphore signals.
 - 6) If you would like to utilize the SMAIL's™ *AUTO-ALIGN™* feature to provide non-derailing turnout action without any external detection circuitry. The *AUTO-ALIGN™* feature can be implemented with DCC, DC or AC track power (with some restrictions and when used with a separate power source) .
- Download Application Note AN-6200-01 for details on AUTO-ALIGN™ .*

If you intend to implement any of the above, you will need to solder 3 wires or a terminal block to the Control Terminals identified in Figure 4. If using a terminal block, it should mount to the Program Button side of the board. See Figure 1 on Page 1.

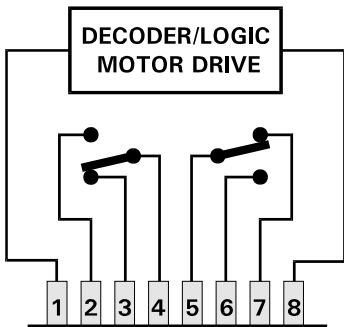


FIGURE 3

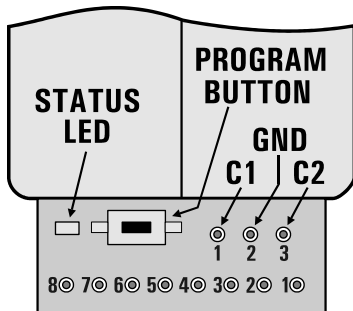
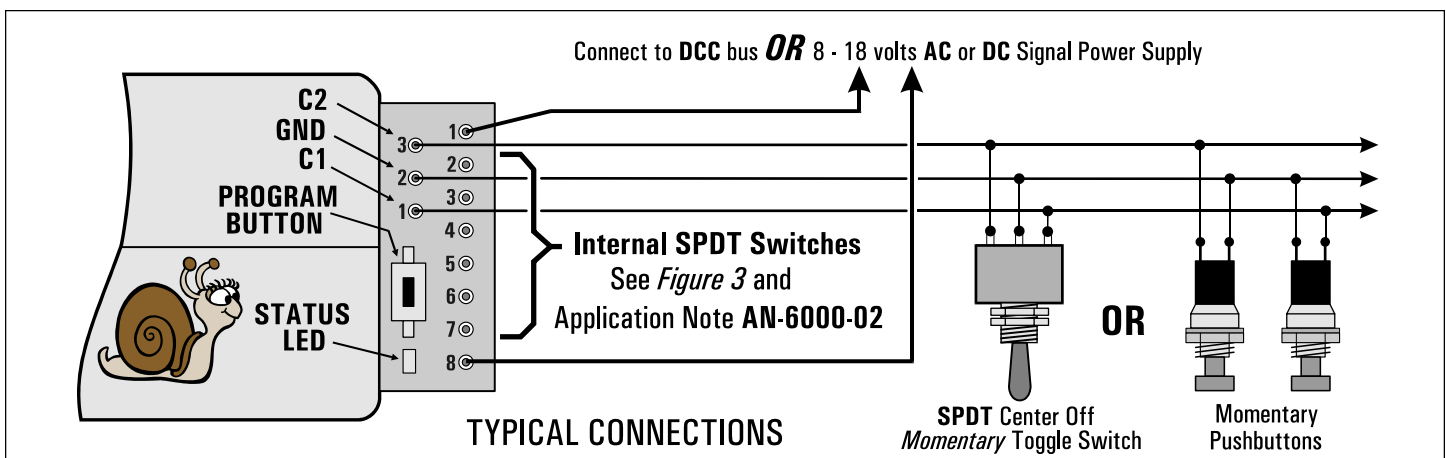


FIGURE 4. Rear View



DCC OPERATION OF THE SMAIL™ AS A SWITCH MACHINE

THE SMAIL™ IS SUPPLIED FROM THE FACTORY IN SWITCH MACHINE MODE SET TO **ACCESSORY ADDRESS 1**

THE SMAIL™ **CANNOT** BE PROGRAMMED ON YOUR PROGRAMMING TRACK. IT IS ALWAYS PROGRAMMED WHILE CONNECTED TO MAINLINE DCC TRACK POWER. The decoder address can be programmed by all systems that support control for paired output accessory decoders using the procedure below and the SMAIL™ will acknowledge the programming of the address by “exercising” the switch machine (moving it from its current position to approximately the half way point then returning to the original position) and lighting the LED.

PROGRAM THE SMAIL™ TO A NEW ACCESSORY ADDRESS:

- 1) Connect DCC track power to the SMAIL™ DCC power connections (numbers 1 and 8).
- 2) Wait 5 seconds.
- 3) Press the programming button on the SMAIL™ circuit board. The LED will start flashing to indicate the SMAIL is in Programming Mode.

NOTE: To prevent accidental programming, the programming button will NOT work for the first 5 seconds after applying power to the SMAIL™. It may be necessary to press and hold this button for three seconds to enter programming mode.

- 4) Use your DCC system to throw the accessory (switch) number (1–2044) you want the SMAIL™ to use as its **NEW** accessory address.
- 5) The SMAIL™ will acknowledge by “exercising”.
- 6) **Remove power after setting the address.**

TO THROW A SWITCH

NCE or MRC Systems	DIGITRAX Systems	LENZ Systems
Press [SELECT ACCY]	Press [SWCH]	Press [F]
Enter the SMAIL™ address	Enter the SMAIL™ address	Press [5]
Press [ENTER]	Press [OPTN] or [CLOC] to throw the switch	Enter the SMAIL™ address
Press [1] or [2] to throw the switch		Press [ENTER]
		Press [+] or [-] to throw the switch

Programming mode (LED Flashing) will remain active for 60 seconds or until a valid accessory command is received.

PROGRAMMING THE DCC OPTIONS AND FEATURES OF THE SMAIL™ (CVs)

THE SMAIL™ COMES ALREADY SET UP WITH THE MOST POPULAR **CV** SETTINGS FOR NORMAL USE. THE SMAIL™ **CANNOT** BE PROGRAMMED ON YOUR PROGRAMMING TRACK. IT IS ALWAYS PROGRAMMED WHILE CONNECTED TO THE MAINLINE DCC TRACK POWER.

Procedure for programming Accessory CVs with an NCE or other system providing Accessory OPs Mode Programming:

- 1) Press the [**PROG/ESC**] button on your cab.
- 2) Press [**7**] to go to the Program Accessories menu.
- 3) Press [**ENTER**] to access the menu.
- 4) Follow the menus to program the desired CVs.

Procedure for programming accessory CVs with a Digitrax, Lenz, MRC or other system that **DOES NOT** support Accessory OPs Mode Programming:

- 1) Press the programming button on the SMAIL™ to enter programming mode.
- 2) Use your DCC system to use locomotive OPs mode programming to the desired CV.
- 3) The SMAIL will accept locomotive OPs programming commands at any locomotive address while the LED is flashing.
- 4) The LED will stop flashing after 60 seconds or when an OPs CV programming command is received.
- 5) Repeat the process for each CV you wish to program.

THE SMAIL™ WILL ACKNOWLEDGE THE PROGRAMMING OF EACH CV BY “EXERCISING” THE SWITCH MACHINE (MOVING IT FROM ITS CURRENT POSITION TO APPROXIMATELY THE HALF WAY POINT THEN RETURNING TO THE ORIGINAL POSITION) AND LIGHTING THE LED. ONE EXCEPTION IS THE PROGRAMMING OF CV556 WHICH WILL ONLY BRIEFLY FLASH THE LED.

PROGRAMMABLE FEATURES (CVs) OF THE SMAIL™

The SMAIL™ factory default NMRA ACCESSORY address is 1.

The SMAIL™ factory default NMRA SIGNAL address is 1.

CV546: Reset the SMAIL to factory defaults

Program 85 into CV546 and the SMAIL will restore all CVs to original factory settings. **You must remove the power after reset** for the SMAIL to return to normal operation.

CV547: Make CV556 non-volatile (“Sticky”)

When CV547 = 1 it will make CV556 non-volatile (SMAIL will remember the settings of CV556 during power off (or power loss). If CV547 = 0 the value programmed into CV556 will be lost the next time power to the SMAIL is removed.

CV548: “Toggle” the outputs using only 1 pushbutton

Setting CV 548 to a value of 1 uses C1 to “toggle” the switch machine output. Each press of C1 will alternate the switch position. C2 is disabled when toggle mode is enabled. Set CV548 = 1 to enable the toggle option or 0 to disable it.

CV549: Report SMAIL software version

Setting CV 549 to any value will cause the SMAIL to flash its LED in a two digit code indicating the software version. It will flash the version four times, then return to normal operations.

CV556: Pushbutton lockout

On some layouts it may be desirable to disable operation of the local control pushbuttons. Setting CV556 to a value of 1 prevents operation of the decoder by the buttons. Setting CV556 to 0 enables operation of these buttons. You can disable or enable ALL decoders on the layout at the same time by using the accessory decoder broadcast address of 2044 when programming CV556.

CV558: Signal Mode:

You can set the SMAIL to operate 3 position semaphore signals under DCC control. Set CV558 to 1 to enable NMRA signal mode, 2 for Digitrax signal mode. Can also be used for crossing gates. To disable semaphore mode, set CV558 to 0.

CV580: Aspect for top semaphore position:

CV580 holds the NMRA signal aspect value that will move the SMAIL to the “top” (Reverse) semaphore position. The factory value is 2.

CV581: Aspect for middle semaphore position:

CV581 holds the NMRA signal aspect value that will move the SMAIL to the “middle” semaphore position. The factory value is 1.

FACTORY DEFAULT SETTINGS

CV NUMBER	DESCRIPTION	DEFAULT VALUE
546	Reset CV	0
547	Make CV556 "sticky"	0 (Disabled)
548	Toggle Using C1	0 (Disabled)
556	Control Terminal Lockout	0 (Disabled)
558	DCC Signal Mode	0 (Disabled)
580	Top Position Aspect	2 (Green/Clear)
581	Middle Position Aspect	1 (Yellow/Approach)
582	Bottom Position Aspect	0 (Red/Stop)
584	Direction of Travel	0 (Normal)
586	DC polarity Enable	1 (Disabled)

CV582: Aspect for bottom semaphore position:

CV582 holds the NMRA signal aspect value that will move the SMAIL™ to the "bottom" (Normal) semaphore position. The factory value is 0 (absolute stop).

CV584: Polarity reversal for turnout or semaphore position:

Setting CV584 to 1 will reverse the direction of operation for the SMAIL™ when a DCC command is received. Set CV584 to 0 to return the SMAIL to normal direction of operation.

CV586: DC mode polarity enable:

Setting CV586 to 0 enables traditional Tortoise like response to DC polarity on pins 1 and 8 of the SMAIL™. Values other than 0 (1-255) disable polarity sensitive operation of the SMAIL™.

ALWAYS RESTORE THE SMAIL™ TO FACTORY DEFAULTS USING CV546 BEFORE CHANGING FROM DCC TO DC POWER.

Download AN-6200-02 from our website for more information.

USING THE SMAIL™ FOR SEMAPHORE SIGNALS OR CROSSING GATES WITH DCC COMMANDS

TO USE THE SMAIL™ FOR SEMAPHORE SIGNALS OR CROSSING GATES WITH AC OR DC DETECTION AND CONTROL, SEE THE NEXT SECTION.

The SMAIL™ can be controlled by DCC system commands when in DCC Signal Mode. 2 methods are supported. In DCC Signal Mode, inputs C1 and C3 are inactive.

TO PROGRAM THE SMAIL TO A NEW SIGNAL ADDRESS:

- 1) Connect DCC track power to the SMAIL track connection (numbers 1 and 8).
- 2) CV558 must be set to 1 before programming for the signal address to be accepted,
- 3) Press the programming button on the SMAIL's™ circuit board. The LED will flash indicating the SMAIL is in programming mode.

NOTE: To prevent accidental programming, the programming button will NOT work for the first 5 seconds after applying power to the SMAIL™. It may be necessary to press and hold this button for two to three seconds to enter programming mode.

- 4) Use your DCC system to issue a *signal command* using the *signal address* that you want the SMAIL to use as its **new** address.

OPERATION AS AN NMRA SIGNAL DECODER: *NOTE: CV558 must be set to 1 to enable NMRA signal packet decoding.*

The SMAIL will accept an NMRA *SIGNAL Address* (range 1-2044) and NMRA signal control packets to control a semaphore signal. NMRA signal aspect 0 moves the semaphore to the bottom (Red / Stop) position, aspect 1 moves the semaphore to the middle (Yellow / Approach) position and aspect 2 moves it to the top (Green / Clear) position.

NOTE: When in NMRA Signal Mode, the decoder is using an NMRA *SIGNAL Address* so using ACCESSORY OPs programming will not work. Use SIGNAL OPs program mode **or** push the program button on the SMAIL™ and use LOCO Ops programming mode. With NCE systems, Signal Ops programming mode is accessed by pressing [PROG/ESC] followed by [0] on your ProCab or Power Cab. The SMAIL™ is supplied from the factory set to Signal Address 1

NOTE: If you want to change a SMAIL™ back to Switch Machine Mode, you will need to change CV558 back to 0 first.

To issue a signal command using the NCE system (no other systems are known to send NMRA signal commands):

- 1) Hold down [SHIFT] and press [CLEAR] at the same time.
- 2) Type in the desired signal number followed by [ENTER]
- 3) Press [0] to issue the command for Signal Aspect 0, press [1] for Signal Aspect 1, etc.

OPERATION AS A DIGITRAX™ SIGNAL DECODER: *NOTE: CV558 must be set to 2 to enable Digitrax™ signal packet decoding.*

Digitrax™ uses 2 consecutive *Accessory Addresses* for signal operation to provide up to 4 signal aspects. When CV558 is set to [2] the SMAIL™ will operate as a Digitrax™ signal decoder by decoding two consecutive accessory addresses. Set the SMAIL's™ accessory address as described above. Use your Digitrax system to operate the SMAIL™ as any other signal.

NOTE: As with Digitrax signal decoders the "base" address must be an odd number (1, 3, 5, 7 etc.)

Base address thrown = bottom (Red / Stop) position
 Base address closed = middle (Yellow / Approach) position
 Base address + 1 thrown = top (Green / Clear) position
 Base address + 1 closed = no operation (ignored)

CONTROLLING CROSSING GATES WITH DCC:

Crossing gates can be controlled by the SMAIL™ using DCC commands by eliminating the middle position commands and sending only the Bottom and Top commands from either NMRA compatible systems or Digitrax™ systems. Follow the instructions above. The speed of the SMAIL™ for these applications can be reduced (with limitations) by inserting 2 back to back zener diodes in one of the power supply leads. *Download Application Note AN-6200-02 from our website for more details.*

OPERATION WITH A DC (or AC) POWER SOURCE AND/OR DETECTION CIRCUITS

The SMAIL™ has two modes of operation available when powered by a DC source, (1) Switch Machine and (2) Crossing Gate/Semaphore.

DC SWITCH MACHINE MODE

As supplied from the factory, the SMAIL™ will default to standard Switch Machine Mode. Unlike the TORTOISE™, reversing the DC input polarity on terminals 1 and 8 will have no effect. In Switch Machine Mode, the Control Terminals C1 and C2 require only a momentary connection to ground (pushbutton) to set the position information and move the SMAIL™. The new position will be retained (even when power is removed and restored) until the next Control Terminal command is received. Panel pushbuttons may be located on as many panels as needed to provide control from multiple locations. The SMAILS™ can also be controlled with a conventional diode matrix for route control. *Download Application Note AN-6200-03 Diode Matrix Control of the SMAIL™ for more information.* The Control Terminals can also be used with Detection Circuit outputs that provide a ground. A continuous ground on one of the Control Terminals such as with a Center-Off SPDT panel toggle switch will “force” the SMAIL™ to one position or the other. This function can be used as a Dispatcher Override. That SMAIL™ will remain in one position until the toggle is returned to the center off position at which time it will resume accepting momentary commands. The toggle should have its center terminal connected to the GND terminal on the SMAIL™ and the two outside terminals go to C1 and C2 on the SMAIL™.

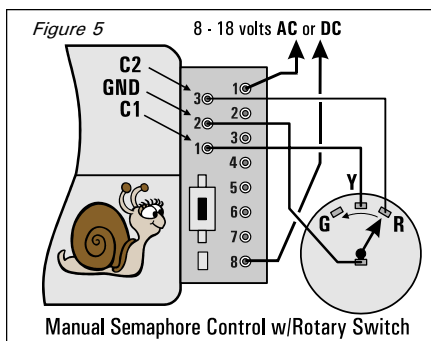
NOTE: The SMAIL™ can be powered (WITH SOME LIMITATIONS) from an AC power source for Tin-Plate and Hi-Rail applications, and all functions above will work. The AC source **MUST** be less than 18 volts AS MEASURED WITH NO LOAD ON A GOOD METER. Exceeding 18 volts *WILL* damage the decoder and this is not covered by warranty. **BE CAREFUL!!** Many current power packs exceed 18 volts on their AC accessory terminals. *Download Application Note AN-6200-04 Powering the SMAIL™ from AC.*

DC CROSSING GATE / SEMAPHORE MODE

When in Crossing Gate / Semaphore Mode, the SMAIL™ will respond to GROUND inputs on its control terminals C1 and C2 in a momentary manner. That is, without any Ground signal on either C1 or C2, the SMAIL will run to the top (Green or Clear) position. With a Ground applied to C2, the SMAIL™ will move to the bottom (Red or Stop) position. With C1 Grounded (and not C2), the SMAIL™ will move to the center (Yellow or Approach) position. As long as a Control Terminal remains grounded by either a manual switch (*see Figure 5*) or detection, the SMAIL™ will remain in that position. C2 will always override C1. The top and bottom positions can be interchanged, if desired, to work with any type of 3 position semaphore signal or control linkage. Crossing gate applications will only require the use of C2 since there are only two positions desired. *Note that the Detection Circuit power supply and SMAIL™ power supply must share a common GROUND [-] connection.* *Download Application Note AN-6200-05 for more information and wiring diagrams on using the SMAIL™ for Grade Crossing and Semaphore Signal applications.*

CHANGING MODES

- 1) Connect **DC** power (DCC power will not work here) to the SMAIL™.
 - 2) Make certain that C1 and C3 are **UNCONNECTED**.
 - 3) Wait 10 seconds, then press and release the PROGRAM button. The button will not work until 10 seconds of no activity has elapsed.
 - 4) The SMAIL™ will begin to flash its LED with a repeating status code. 1 flash indicates normal Switch Machine Mode. 2 flashes indicate Semaphore Mode.
 - 5) Once the LED is flashing, press and hold the PROGRAM button for about 3 seconds. This will change the mode and “exercise” the machine indicating the status has changed. Each subsequent press will again change the mode.
 - 6) **When you have the SMAIL™ in the desired mode, remove power from the SMAIL before returning it to operation.**
- NOTE: If the SMAIL does not start flashing the LED it may be necessary activate the SMAIL™ by grounding either C1 or C3 to “get its attention”..... then go back to step 2.*



IF YOU NEED TO INTERCHANGE THE TOP & BOTTOM POSITIONS

- 1) Connect **DC** power to the SMAIL™.
- 2) Wait 10 seconds then press and release the PROGRAM button. The button will not work until 10 seconds of no activity has elapsed.
- 3) Connect C1 to ground.
- 4) The SMAIL™ will begin to flash its LED in a repeating status code representing whether the SMAIL™ has polarity reversed. 3 flashes indicate normal operation. 4 flashes indicate reverse polarity.
- 5) Press (about 3 seconds) and release the PROGRAM button to change the mode and the machine will “exercise” indicating the status has changed. Pressing the button again will change the status back to NORMAL.

When finished, remove power from the SMAIL before returning it to operation.

ALWAYS RESTORE THE SMAIL™ TO FACTORY DEFAULTS BEFORE CHANGING FROM DC TO DCC POWER.

Download AN-6200-02 from our website for more information.

LIMITED WARRANTY

CIRCUITRON warrants the SMAIL™ against defects in materials and workmanship for a period of one (1) year from the date of purchase. CIRCUITRON will repair or, at its option, replace those components that prove defective, provided the product is returned (properly packed and shipping prepaid) directly to the factory. This warranty covers all defects incurred in normal use of the SMAIL™ and does not apply in the following cases:

1. If damage to the device results from abuse, mishandling, accident or failure to follow instructions.
2. If failure of the auxiliary switching contacts results from application of current loads exceeding the ratings.
3. If either the product label or date stamp label have been damaged, altered or removed.
4. If the product has been used for a purpose other than that intended or in a commercial or club layout.

Requests for warranty service must include a dated proof of purchase, a written description of the nature of the problem and \$5.00 US for shipping and handling (outside the US, include \$8.00 US).

EXCEPT AS PROVIDED ABOVE, NO OTHER WARRANTY OR GUARANTEE, EXPRESS OR IMPLIED INCLUDING MERCHANTABILITY, ON THE PART OF CIRCUITRON OR ANY OTHER PERSON, FIRM OR CORPORATION, APPLIES TO THIS DEVICE.