HANDHELD THROTTLE

by Don DeWitt

The handheld throttle (See Figure 1) has been used for several years by the Central Jersey S Sealers club for their modular layout. Kent Singer was the original developer of the throttle, and minor modifications have been suggested by Kevin Ross and Don DeWitt and incorporated into the current version.

This throttle has several advantages over commercially available throttles. The throttle is relatively simple in terms of components. The components are easy to obtain (see Figure 1). It uses 15-20 VAC input which is easily obtained from American Flyer transformers. It is quite rugged, but if it does fail, it is easy to repair... this is very important in the modular railroading business as many conditions present themselves which can lead to stress to a throttle (e.g., shorts, dropping the throttle, etc.). This lifestyle can be catastrophic to some of the commercially available throttles, and if they fail the owner will find it difficult or impossible to make repairs.

Unfortunately, not all of the components are available from Radio Shack. These include the 1.5K potentiometer and the circuit breaker. The 1.5K potentiometer can be replaced by a 2K potentiometer but the best "feel" is obtained with the 1.5K pot. I have used these throttles built with 1K potentiometers and I felt that the response was too coarse. The circuit breaker is an item carried by most "other" electronics shops or they can order it for you. There are other brands of circuit breakers that could be used instead.

At 3 amps maximum current, this throttle is designed to be used with scale locomotives. Thus this throttle is not designed to run DC American Flyer because of the larger current draw of the Flyer locomotives. One locomotive could be run, but added engines, lighted cars, etc. will bring it to overload. In addition, if you have installed the Dallee Regulated Lighting kits in your American Models passenger cars, you will be unable to run a 5 or 6 car train with locomotives as the current draw is too large. The current carrying capacity can be increased somewhat by using a larger amperage circuit breaker; however, the bridge rectifier which now can handle only 4 amps would need to be replaced. Larger sizes are available through Radio Shack (e.g., 6 amp and 15 amp). Another important factor is that as the current increases the cooling capacity of the system must be increased. Eventually, the throttle would become too warm to handle and the transistor could fail. The cooling fins for the externally mounted transistor are an option that is more important for throttles that will be used for continuous running or for throttles built to produce larger currents. Throttles used for local switching are less likely to be in continuous operation and will probably remain cooler. Finally, the 5 amp DPDT direction switch should be replaced if you exceed its rating.

An alternative throttle that keeps the heat-producing component out of the handheld control box is shown in Figure 2. I have not built one of these but it should work. Please let me know if you try it. A similar throttle is commercially available from RIX.

The LED indicators are also optional but we have found that the direction indicator is most useful. The short indicator is also quite helpful as well. When you install the direction indicator, the TRI-COLOR LED is the easiest to install because it has only two leads. The third color (Yellow) is not used in this application. If you purchase a RED/GREEN LED then you will have three leads and the wiring will be slightly more complicated.

When you install the transistor make sure you use the insulating kit and make sure you use the insulating bushings for the mounting screws. Make sure that you completely isolate the transistor from the aluminum box. You should also use silicone grease for maximum heat transfer.

Handheld Throttle Schematic

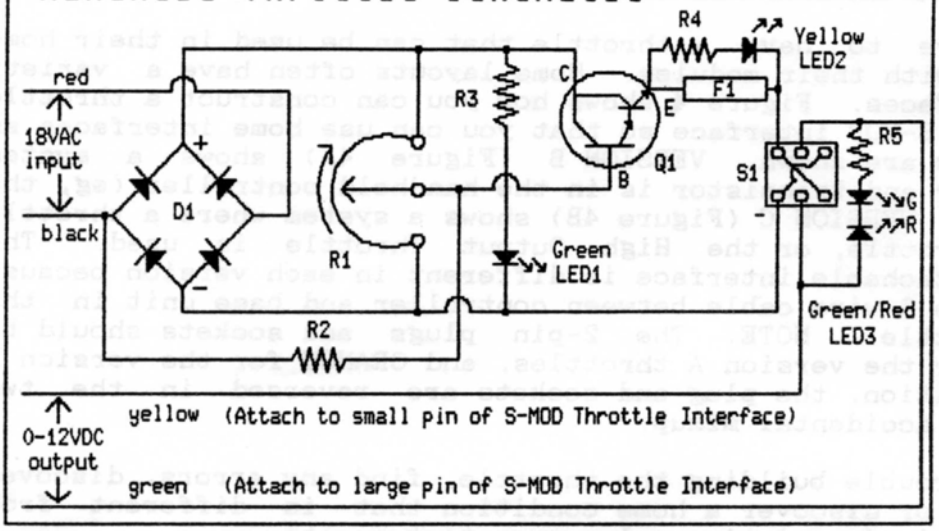
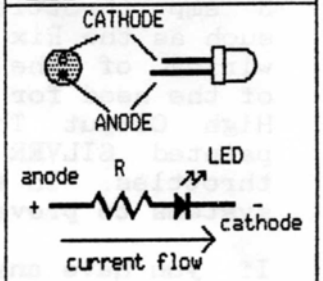


Figure 1

LED Information



To calculate the value of the current limiting resistor in ohms, use:

$$R=\frac{(E-1.7\text{volts})\times 1000}{I}$$

where E is the voltage applied and I is the LED current in milliamps. Eg., at I=20mA, and E=6v, R=220 ohms.

Handheld Throttle Parts List

PARTS LIST:

1. R1- 1500 ohm wire-wound, linear taper, potentiometer
2. R2- 220 ohm, 1 watt resistor (10%)
3. R3-R5- 490 ohm, 0.25 watt resistor (10%)
4. D1- 4 amp, 100 piv. Bridge Rectifier (Radio Shack #276-1171)
5. LED1- Green LED POWER ON indicator (RS #276-022)
6. LED2- Yellow LED SHORT CIRCUIT indicator (RS #276-021)
7. LED3- Green/Red LED DIRECTION indicator (RS Tri-Color LED, #276-035)
8. F1- Circuit Breaker, 3 amp (Littlefuse 815003)
9. Circuit breaker adaptor (Littlefuse 815000 PA)
10. S1- DPDT, Center Off, Toggle Switch (5 Amp)
11. Q1- NPN Darlington Transistor (SK3948 or 2N3055- RS #276-2041)
12. Cooling Fins for surface mounted Darlington Transistor)
13. TO-3 Transistor mounting hardware (used with 2N3055 Q1)(RS #276-1371/2)
14. Rubber Grommet
15. 4-wire cable
16. #2-56 0.25 inch screws with nuts and lock washers (2 needed)
17. Panel mounts for LEDs (3 needed) (RS #276-079)
18. Knob for speed control
19. Aluminum Box (RS #270-239)

LED1 SHOULD GLOW IF THE TRANSFORMER IS TURNED ON.

LED2 SHOULD GLOW ONLY WHEN THERE IS A SHORT AND THE CIRCUIT BREAKER HAS RELEASED.

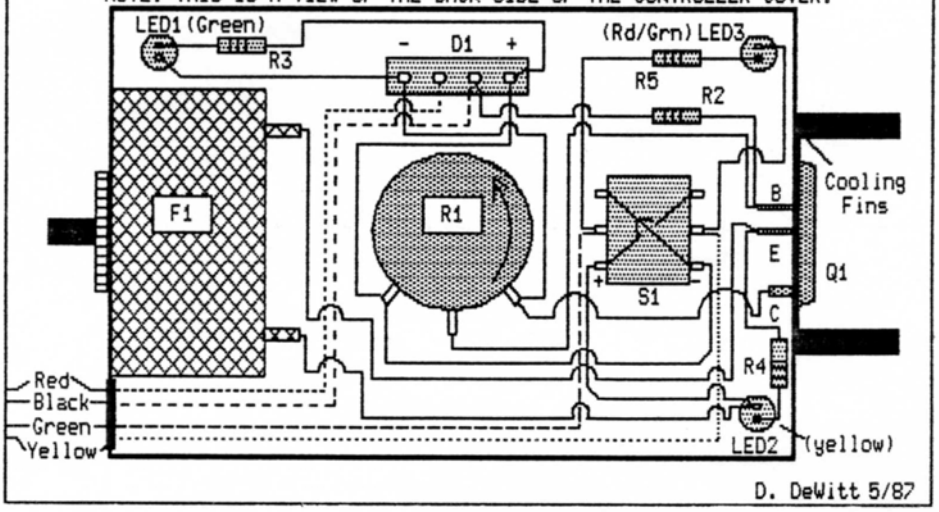
WHEN THE GREEN WIRE (LARGE PIN OF THE S-MOD INTERFACE) IS +, THEN THE DIRECTION INDICATOR LED (LED3) SHOULD SHOW GREEN.

WHEN THE LARGE PIN IS -, LED3 SHOULD SHOW RED.

WHEN THE POTENTIOMETER IS TURNED FULLY TO THE LEFT (COUNTERCLOCKWISE) LED3 SHOULD BE OFF. AS THE POTENTIOMETER IS TURNED CLOCKWISE, LED3 SHOULD GLOW BRIGHTER.

Handheld Throttle Wiring Diagram

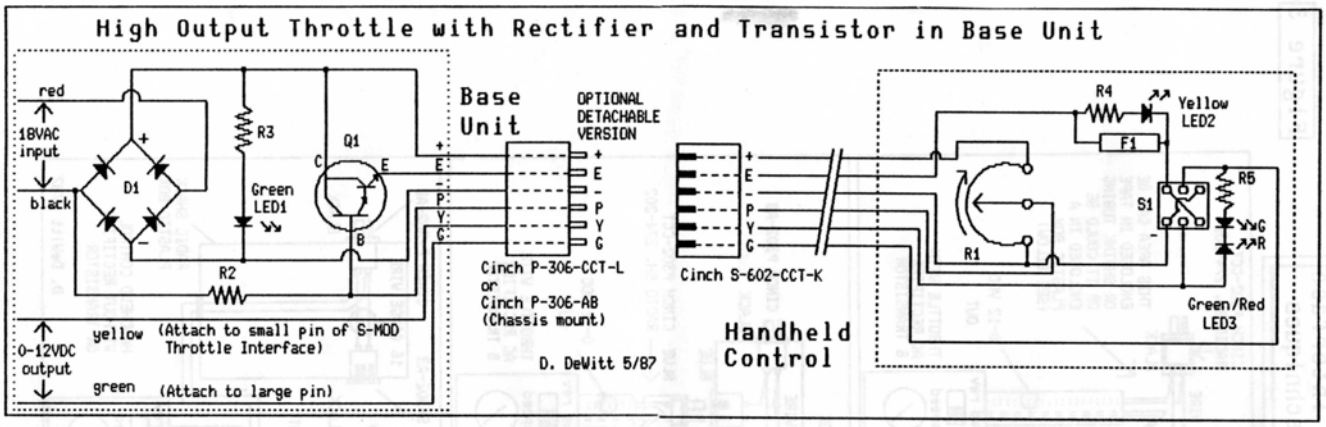
NOTE: THIS IS A VIEW OF THE BACK SIDE OF THE CONTROLLER COVER.



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For the four-wire cable, I recommend as large as you can find up to 16 gauge. This will help to reduce the voltage drop throughout the layout as the throttle output may be carried through the system for great distances. The throttle can be attached to a module by hook and eyelet or by attaching Velcro strips to

the back and to the module sides at reasonable distances around the layout. By tradition, we have attached the "hook" side of the Velcro to the throttle and the "loop" side to the modules.



High Output Throttle Parts List

PARTS LIST: (* = items different from 3 Amp Throttle)

1. R1- 1500 ohm wire-wound, linear taper, potentiometer
2. R2- 220 ohm, 1 watt resistor (10%)
3. R3-R5- 490 ohm, 0.25 watt resistor (10%)
* 4. D1- 15 amp, Bridge Rectifier (Radio Shack)
5. LED1- Green LED POWER ON indicator (RS #276-022)
6. LED2- Yellow LED SHORT CIRCUIT indicator (RS #276-021)
7. LED3- Green/Red LED DIRECTION indicator (RS Tri-Color LED, #276-035)
* 8. Circuit Breaker, larger amperage as desired
* 9. S1- DPDT, Center Off, Toggle Switch (10-15 amp as desired)
10. Q1- NPN Darlington Transistor (SK3948 @12 Amp or 2N3055 @15 Amp)
11. Cooling Fins for surface mounted Darlington Transistor)
12. TO-3 Transistor mounting hardware (used with 2N3055 Q1)(RS #276-1371/2)
13. Rubber Grommet
*14. 6-wire cable & 2 wire cable (16 gauge)
15. #2-56 0.25 inch screws with nuts and lock washers (2 needed)
16. Panel mounts for LEDs (3 needed) (RS #276-079)
17. Knob for speed control
18. Aluminum Box (RS #270-239)
*19. Plastic Box for Handheld Control
*20. Cinch Plug and Socket for Optional Detachable version D. DeWitt 5/87

Figure 2

USING THE THROTTLE IN THE S-MOD SYSTEM.

If the throttle is going to be used with S gauge modules then the S-MOD Throttle Interface Connector System will be required. This system is shown in the accompanying figures 3A, B, & C. The essence of the system is that any throttle should be capable of acting as a local or mainline throttle. Local throttles are usually connected to a cab selector panel, while mainline throttles are connected to the layout wiring by being inserted between interface connectors of adjacent modules. This is accomplished by constructing the Throttle Interface with its 2-pin plug/socket combination. Note that the S-MOD Throttle Interface can be built in several ways... with or without a plastic box. In addition, either version can be built with a permanently attached interface or a detachable version (Figures 3A & B).

There are disadvantages to "no-box" and "boxed" versions. The "no-box" method is the most versatile to use but the most difficult to build as the 16 gauge wire is difficult to fit into the sheath surrounding the plugs and sockets. The slenderness of this style allows one to plug the throttle interface into LOCAL CAB sockets on the surface of Cab Selector Panels. The "boxed" version using panel mount plugs and sockets is much easier to wire but is difficult to plug into a LOCAL CAB socket of a Cab Selector Panel without a special extender cable (two 16 gauge wires attached to a 2-pin plug and socket.) I prefer the "boxed" method for our mainline throttles and the I carry around a couple of extender cables in my box of supplies for that case when a local cab fails and must be replaced by one of our extra mainline throttles. An alternative "detachable boxed" method is shown as Detachable version A in Figure 3B. NOTE, however, that in this version the box is not an option. You will be expected to show up at an S-MOD gathering with throttles that can be used in an emergency as a mainline throttle. This means that it should be able to be connected between adjacent modules. This is accomplished by the male/female connector combination in the S-MOD Throttle Interface.

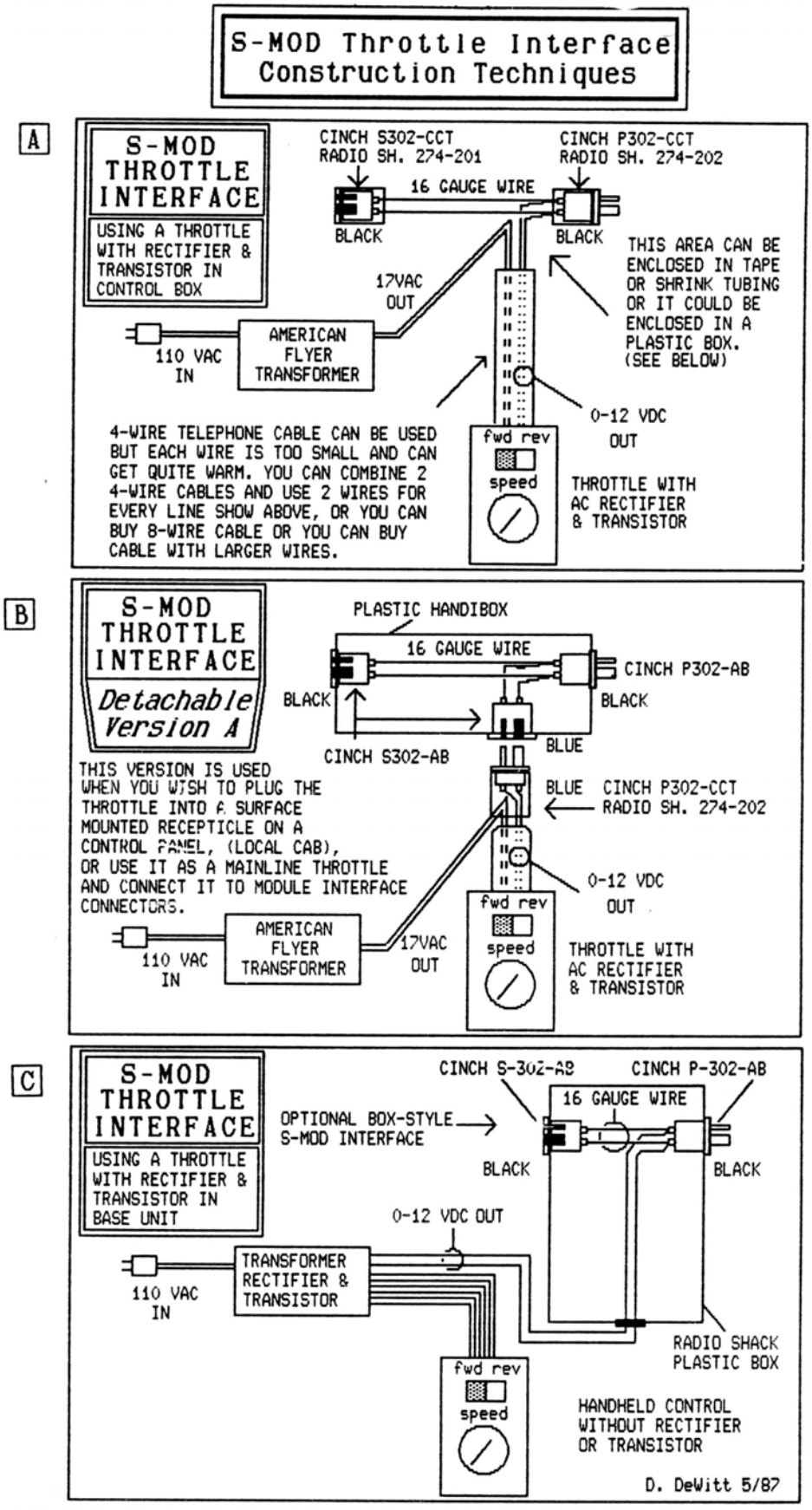

S-MOD Throttle Interface
Construction Techniques
A
S-MOD THROTTLE INTERFACE
USING A THROTTLE WITH RECTIFIER & TRANSISTOR IN CONTROL BOX
CINCH S302-CCT
RADIO SH. 274-201
CINCH P302-CCT
RADIO SH. 274-202
16 GAUGE WIRE
BLACK
BLACK
THIS AREA CAN BE ENCLOSED IN TAPE OR SHRINK TUBING OR IT COULD BE ENCLOSED IN A PLASTIC BOX. (SEE BELOW)
17VAC OUT
110 VAC IN
AMERICAN FLYER TRANSFORMER
0-12 VDC OUT
fwd rev
speed
THROTTLE WITH AC RECTIFIER & TRANSISTOR
4-WIRE TELEPHONE CABLE CAN BE USED BUT EACH WIRE IS TOO SMALL AND CAN GET QUITE WARM. YOU CAN COMBINE 2 4-WIRE CABLES AND USE 2 WIRES FOR EVERY LINE SHOW ABOVE, OR YOU CAN BUY 8-WIRE CABLE OR YOU CAN BUY CABLE WITH LARGER WIRES.
B
S-MOD THROTTLE INTERFACE
Detachable Version A
PLASTIC HANDIBOX
16 GAUGE WIRE
CINCH P302-AB
BLACK
BLACK
BLUE
CINCH S302-AB
THIS VERSION IS USED WHEN YOU WISH TO PLUG THE THROTTLE INTO A SURFACE MOUNTED RECEPTICLE ON A CONTROL PANEL, (LOCAL CAB), OR USE IT AS A MAINLINE THROTTLE AND CONNECT IT TO MODULE INTERFACE CONNECTORS.
BLUE
CINCH P302-CCT
RADIO SH. 274-202
0-12 VDC OUT
fwd rev
speed
THROTTLE WITH AC RECTIFIER & TRANSISTOR
110 VAC IN
AMERICAN FLYER TRANSFORMER
17VAC OUT
C
S-MOD THROTTLE INTERFACE
USING A THROTTLE WITH RECTIFIER & TRANSISTOR IN BASE UNIT
CINCH S-302-AB
CINCH P-302-AB
16 GAUGE WIRE
OPTIONAL BOX-STYLE S-MOD INTERFACE
BLACK
BLACK
0-12 VDC OUT
TRANSFORMER RECTIFIER & TRANSISTOR
110 VAC IN
RADIO SHACK PLASTIC BOX
fwd rev
speed
HANDHELD CONTROL WITHOUT RECTIFIER OR TRANSISTOR
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Figure 3.

USING YOUR THROTTLE WITH ITS S-MOD INTERFACE AT HOME

Many people desire to have a throttle that can be used in their home layout as well as with their modules. Home layouts often have a variety of throttle interfaces. Figure 4 shows how you can

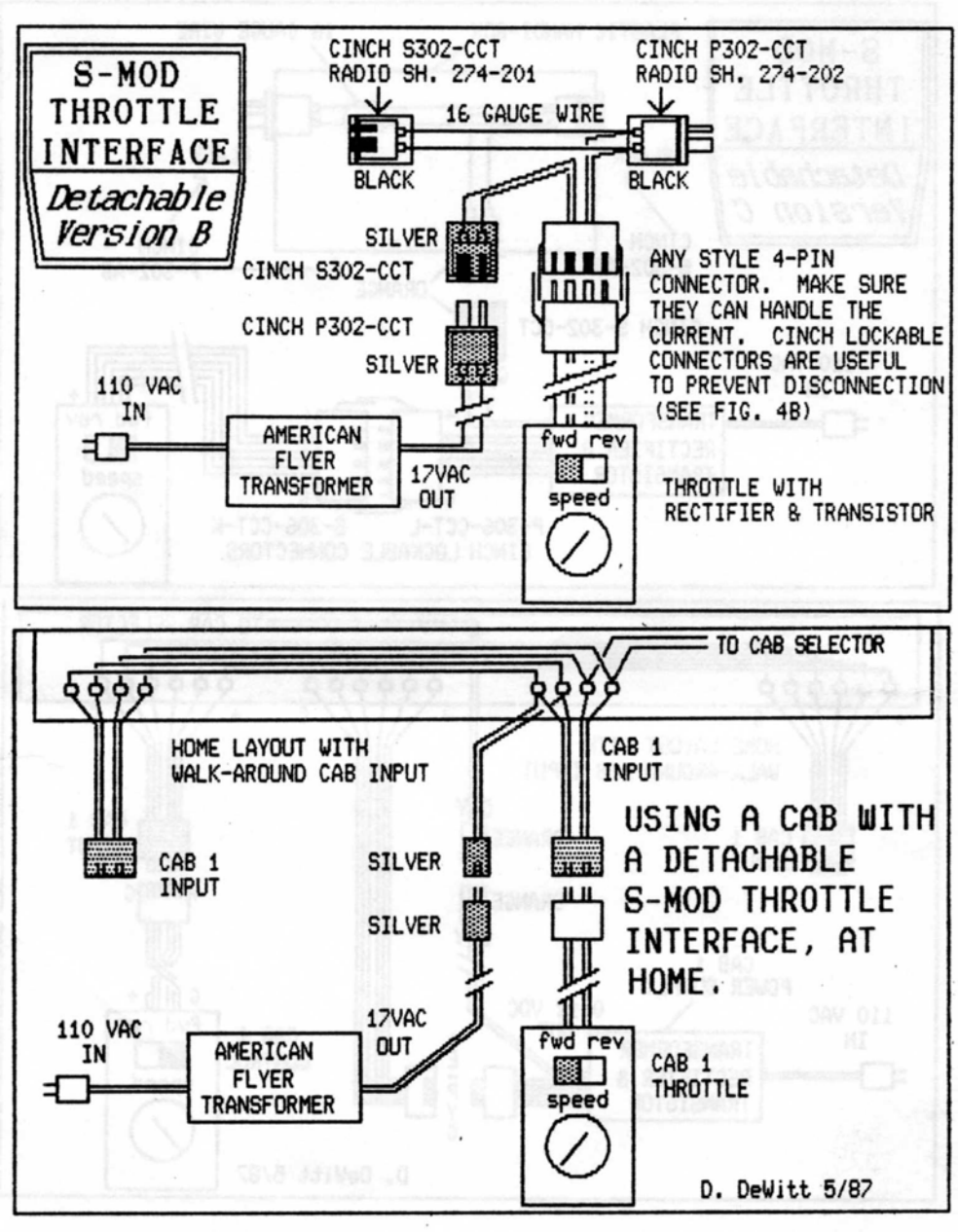


Figure 4a.

construct a throttle with a detachable S-MOD interface so that you can use home interfaces as well. Two versions are shown. VERSION B (Figure 4A) shows a system where the rectifier and transistor is in the handheld controller (e.g., the 3 amp throttle). VERSION C (Figure 4B) shows a system where a throttle such as the Rix throttle or the High Output Throttle is used. The wiring of the detachable interface is different in each version because of the need for the 6-wire cable between controller and base unit in the High Output Throttle. NOTE: The 2-pin plugs and sockets should be painted SILVER for the Version A throttles, and ORANGE for the Version B throttles. In addition, the plugs and sockets are reversed in the two systems to prevent accidental mix-up.

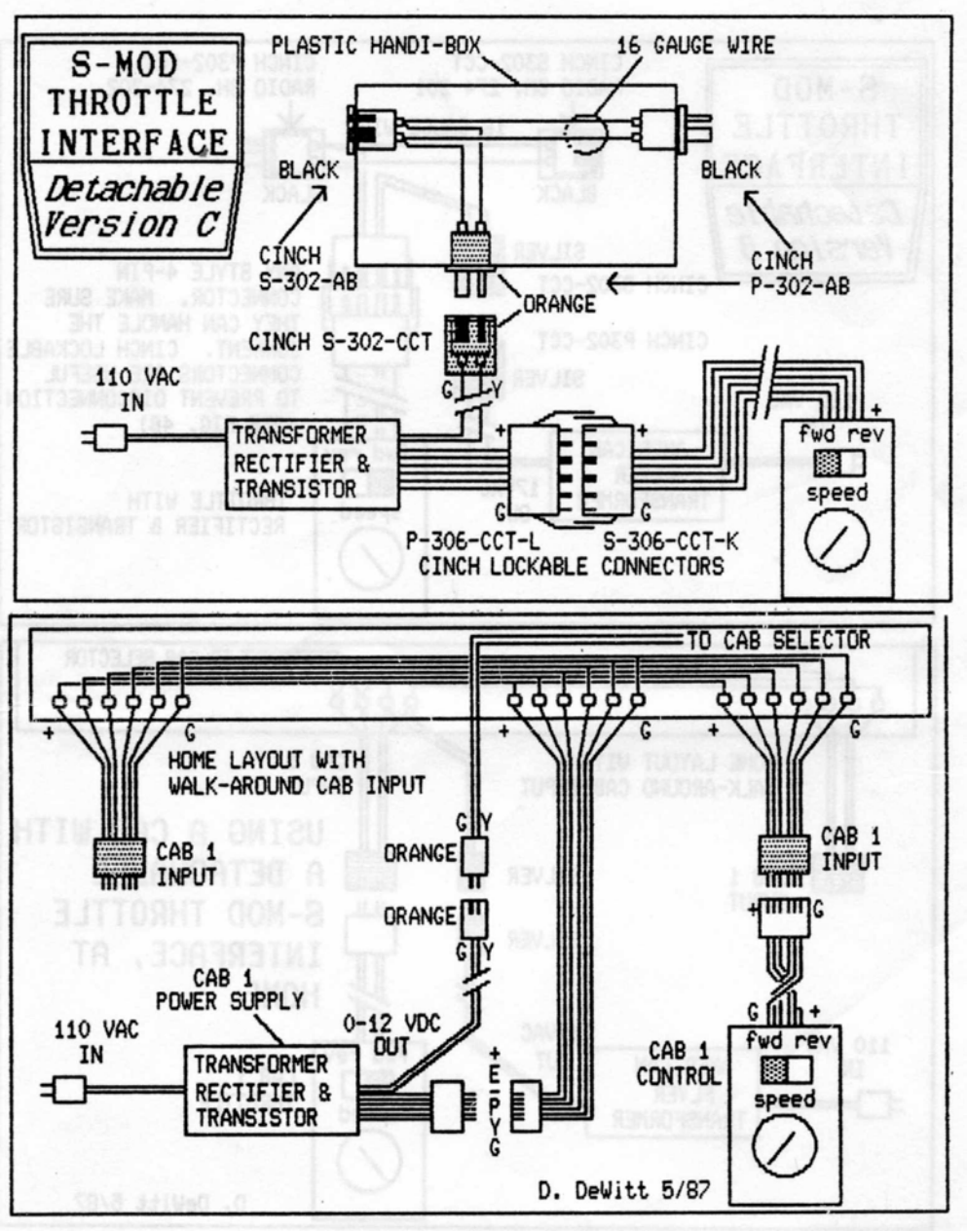


Figure 4b.

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