DS78V

Eight Servo LocoNet Stationary/Accessory decoder for turnout control.

Features:

- 8 output channel LocoNet based Stationary decoder for operating eight 9G-type servo motors for turnout or general motion control.
- Plug-in connectors for simple and easy installation and service.
- User defined 8 consecutive switch (SW) addresses in 2000+ SW range.
- Stabilized 5 Volt servo drive voltages.
- Easy setup with Option Switches (OPSW) or LocoNet CV programming.
- Power input from 2mm DC jack, or DCC track voltage, 10V min to 20V max.
- 16 easy to setup System Routes, with 8 SW Entries each.
- 16 input control lines; 8 for Output/SW change and 8 Sensor/DS inputs.
- Additional advanced LocoNet Configuration modes using DT602 throttles.

Parts List

1 DS78V Stationary Decoder   2 10-pin pluggable input cables

1 Instruction Sheet

1.0 DS78V Quick Start - Eight servos, Thrown/Closed

The DS78V is simple to install and begin using on your LocoNet based layout.

1. Figure 1 shows the recommended connections to operate the DS78V on a LocoNet layout and to control up to eight mounted servos, like Digitrax DSXSV9's.
2. Connect a PS14 or similar DC 12V power supply to the DS78V via the DC power jack. When powered the green ID LED should light and will briefly wink OFF every 2 secs as a product 'heartbeat' showing the DS78V is operational. Alternatively, power from DCC feeder wires to the TKA/B terminals.
3. Plug in an active LocoNet to a DS78V RJ12 connector. The red OPS LED will light up showing connection. Any good LocoNet message seen will cause the DS78V OPS LED to blink OFF briefly. With no LocoNet the unit will respond to switch commands from a DCC track connection.
4. Press and hold down the ID button for about 3 seconds until the RTS and OPS LEDs blink alternately, then release the ID button.
5. From your system send a SW command to set the Base Board address at this SW#. The OPS and RTS LEDs will stop blinking showing the DS78V has set the unit's Base SW# to the SW# you just sent, which is for Servo1 control.
6. Plug in the servo 3pin connector(s) to the outputs you wish to control. The connector brown wire will be closest to the DS78V beige case top.
7. Operate turnouts with a SW# and direction Thrown (T)/Clockwise(CW) or Closed(C)/Counter-Clockwise(CCW) settings at the; Base SW#, or the next *consecutive* 7 SW#'s now in use by this DS78V.

That's all that's required for installation of your DS78V on LocoNet!

Figure 1: DS78V System and Servo output connections

12V DC in

LocoNet

DS78V

ID
OPS
RTS

Complete Train Control©

To DCC Track (Optional)

8 servo 5 4 servo 1 SW/SENSOR 5-8 SW/SENSOR 1-4

10 pin header cables for 16 input line options

Brown or pin1 edge

Brown or pin1 edge

Servo#8, at Base Board SW address +7

Servo#1, at Base Board SW address +0 (lowest Base Board SW address is 1)

Servo examples in Thrown or Clockwise arm orientation as viewed from arm screw side

1.1 DS78V Quick Start - Eight 3-position semaphores:

To control eight servos driving 3-position semaphores using 16 switch addresses:

1. Follow the steps of section 1.0 to power on DS78V and setup the Base SW#.
2. Press and hold the OPS button for about 3 seconds until the green ID and RTS LEDs blink *alternately*. Release the OPS button. The DS78V is now set-up to configure Option Switch (OPSW) 1 to 40 by sending the required SW# as Closed or Thrown to setup an option as T or C, as defined in Table 1.
3. Issue a **SW#3 Closed** command. This sets OPSW3 to Closed (C). From factory default 2-position mode this will configure the eight servo outputs to the 3-position Semaphore mode, each controlled by 2 SW#'s.
4. In Semaphore mode the DS78V will now respond to 16 SW consecutive addresses *starting* at the unit's Base SW#, in eight SW# pairs.
5. A switch command to the Base SW# will set Servo1 at: full Clockwise angle for T (semaphore STOP/RED) and full Counter-Clockwise for C (semaphore CLEAR/GREEN), as viewed from the arm-end of the servo
6. A switch command at Base SW#+1 will drive Servo1 to the mid-angle or Approach position (semaphore APPROACH/YELLOW) for either T or C.
7. In this way, each servo responds to a consecutive pair of switch commands: the first SW# as T/C and the SW#+1 for the Approach setting. For example: Base SW#+3 sets T/C for Servo2 and Base SW#+4 for T or C sets the center Approach angle setting for Servo2.
8. Press and hold OPS button for about 3 seconds to now exit OPSW setup.
9. Connect linkages from the servo arms to the semaphores as needed.

2.0 Setup DS78V Servo angle Adjustment mode:

The DS78V can be configured to conveniently drive all 8 servo outputs to the; T/CW, Center or C/CCW servo angle positions for testing and installation.

1. To go to Thrown/CW position: double click the RTS button with two quick presses and releases in less than 1 second. All servo arms will go to the T/CW position, and just the Green RTS led will blink rapidly. To exit from adjusting back to normal operation, double click the RTS button again.
2. To go to servo Center position: double click the OPS button with two quick presses and releases in less than 1 second. All servos will go to the center position, and just the Red OPS led will blink rapidly. To exit from adjusting, double click the OPS button again.
3. To go to Closed/CCW position: double click the ID button with two quick presses and releases in less than 1 second. All servos will go to the C/CCW position, and just the Green ID led will blink rapidly. To exit from adjusting, double click the ID button again.
4. You can enter Adjustment mode with just the 12V power hooked up, and do not need a command station, active LocoNet or a throttle to do these servo position adjustments.

3.0 Setup DS78V Ez-Routes:

The DS78V has 16 internal Routes with up to 8 SW# and T/C direction Entries each. These can be set up by Ez-Routes method using the RTS button and switch commands sent from a LocoNet throttle, connected PC or DCC track.

1. Press and hold the RTS button for about 3 seconds and the ID and OPSW LEDs will blink alternately to show one Route can be set up. Release the RTS button.
2. Select a switch address on your throttle between 1 and 16 and issue the command direction for Closed. This will now be the Route Number you are going to setup. Any previous Entries in this Route will now be replaced in following steps.
3. Select the desired TOP Switch address between 1 and 2000 and issue a C or T direction command. This SW# and direction is that which will trigger this Route to be executed when seen by this DS78V
4. Now enter up to 7 more SW# and direction T or C for the other route Entries required. The route entry ID/OPS LED will stop blinking indicating route is full/completed.
5. If you issue a SW# and direction twice consecutively that will also end route entry.
6. If this DS78V does not have a LocoNet connection but operates from DCC Track power on the TKA/B terminals, then it will ignore Route Entries that do not fall within the DS78V's Base address and next 7 servos.
7. Best practice is to set TOP SW#'s in each route in a unique "phantom" switch range e.g. 500 and above that do not control a physical switch. This will identify the issued switch is specifically a TOP or Route-start SW#.
8. Ez-Routes do not have the ability to; read back , review or edit DS78V routes already set up. For more powerful color graphics for comprehensive DS78V Route review and editing consider using a DT602 as noted in section 6.0
9. The green RTS LED will be steady ON if there are any routes programmed.

4.0 Other DS78V Options: OPSW changes

The DS78V configuration and behavior can be configured using 40 OPSW's. The Factory default OPSW settings will configure most common requirements.

1. Press and hold the OPS button for about 3 seconds until the green ID and RTS LEDs blink alternately. Release the OPS button. The DS78V is now setup to configure OPSW 1 to 40 by sending the required SW# as Closed or Thrown to setup an option.
2. Send a SW# in range 1-40 as Closed/Thrown matching the valid settings from OPSW Table 1 choices below.
3. When finished press and hold OPS button for 3 seconds to exit OPSW setup mode. The DS78V will now restart with the new OPSW settings.
4. Factory default OPSW settings are shown in **BOLD**.
5. OPSW's not in this table are reserved and should be kept at Factory default T settings for predictable operation.
6. OPSW40 =C will reset to Factory defaults on OPSW mode exit

Table 1: DS78V OPSW setting table:

OPSW#	Default=**bold**	Action
1,2,3,4	**T,C,T,T** T,C,C,T	**2 position servo (T/C)** 3 position servo, (Semaphore)
6	**T**	C =Disable internal Routes
10	**T**	C= Ignore standard LocoNet SW commands ("Bushby bit")
11	**T**	C= 16 input lines trigger Routes. [No DSXCP1 support]
14	**T**	C= DCC SW commands only. Ignore all LocoNet SW#'s
15	**T**	C= Do not echo Route SW's to Loconet.
40	**T**	C= Factory Reset

5.0 External hardware Input lines:

The DS78V has sixteen external hardware control lines on two "SWITCH/SENSOR IN" 10-pin PCB headers using plug in 10-pin ribbon cables. The 6" Factory ribbon cable pin 1 edge should be on the right side when plugged in, as shown in Figure 1. With Gray cable the red stripe is pin 1 edge, and for 10-color cable pin 1 is BROWN, with wire colors shown in Tables 2 and 3.

If you use these external lines, connect the wires from the pins of Table 2 and 3 to your custom wiring by e.g. screw terminal blocks. If using a Gray non-color ribbon cable, make sure pin 1 and counted pin numbers match Table 2/3 usage.

Alternately, plug in two DSXC4's boards with their ribbon cables, which will support up to 8 DSXCP1 fascia SW controls with servo state indicating LEDs.

A +5V Reference voltage is provided on pin 10/ribbon cable BLACK wire for setting an ON/active level, and a 0V/OFF reference level on pin 9 or the WHITE wire. DO not draw more than 100mA from the BLACK wire. The SW/SENS wires on pins 1/BROWN through 8/GRAY are rated for up to +16V maximum input voltage, but best practice is 0V to 5V operation.

1. The SW1,SW2,SW3,SW4,SW5,SW6,SW7 and SW8 pins will toggle the state of the same number output when briefly connected to the +5V ON voltage on the BLACK wire or pin10. If the DS78V is connected to LocoNet this will occur as a SW# message to make the change and notify the system it has occurred. Wire to momentary press-on buttons for SW control.

2. The pins SENS1,SENS2, SENS3,SENS4,SENS5,SENS6, SENS7 and SENS8 will send a LocoNet Block Occupancy or DS message at the SW# of the output. This will be BLOCK OCCUPIED when the line is above +4V and a BLOCK UN-OCCUPIED when between 0V/ WHITE and +2V.

3. For example; if the SENS2/YEL-LOW line of the left ribbon cable is connected to the BLACK +5V Reference wire, the the DS number reported will be SW# used for Output 2R/2G. If SW10 is the BASE address of the DS78V, then Output2 is SW11 and the DS message will be Block 11 OCCUPIED.

4. A disconnected SENS line will report as UNOCCUPIED.

5. The BD4N does not plug directly into a 10 pin header, and will not operate. Connect the 5 wires used by the BD4N by name via a terminal strip. More conveniently, you may connect the BD4N through one of two plugged in DSXC4 boards with ribbon cables for true plug and play connectivity. This will also allow DSXCP1 SW control and state display.

6. These two sets of ribbon cable wires should not connect to any other voltage levels or loads other than those defined here.

7. For OPSW11 =C: SW1 line ON starts Route1 and SENS1 starts Route2, in order through SENS8 line that starts Route 16. An empty route is ignored.

Table 2: DS78V Input lines 1-4

Pin#	Wire Color	Function
1	BROWN	SW1 Toggle, +momentary
2	RED	SENS1 occupancy level
3	ORANGE	SW2 Toggle, +momentary
4	YELLOW	SENS2 occupancy level
5	GREEN	SW3 Toggle, +momentary
6	BLUE	SENS3 occupancy level
7	VIOLET	SW4 Toggle, +momentary
8	GRAY	SENS4 occupancy level
9	WHITE	0V reference
10	BLACK	+5V reference

Table 3: DS78V Input lines 5-8

Pin#	Wire Color	Function
1	BROWN	SW5 Toggle, +momentary
2	RED	SENS5 occupancy level
3	ORANGE	SW6 Toggle, +momentary
4	YELLOW	SENS6 occupancy level
5	GREEN	SW7 Toggle, +momentary
6	BLUE	SENS7 occupancy level
7	VIOLET	SW8 Toggle, +momentary
8	GRAY	SENS8 occupancy level
9	WHITE	0V reference
10	BLACK	+5V reference

6.0 Advanced DT602 based DS78V configuration

To perform these advanced features, the DT602 will need to be user updated to SubVersion 0.5 or higher, or a July 2021 or later IPL - see www.digitrax.com.

6.1 Detecting all DS78V's and setting Base addresses: On

an updated DT602 *plugged into* LocoNet, press the; Menu>3>4 keys to enter the Route Editor menu. If *any* DS78V is plugged into LocoNet, the DT602 will beep after about one second and show "DS7x" routes at the D soft key position.

1. Press the D soft key to now enter the "Selecting DS7X device:" screen as shown below. This *example* DT602 screen shows four DS78V devices detected on LocoNet, with their; Base SW address, active SW address count# and unique device serial numbers (SN or SerNo).

2. The lowest DS78V Base address *detected and sorted* is SW0001, with 8 outputs and SN 9122. This is displayed in GREEN to indicate that it does NOT conflict with the 2nd DS78V SN 3122 at Base address 9. This is true because the next free address is SW1+8 or SW0009, that 2nd DS78V SN 3122 is set *at or above*. You can use the LH encoder knob to scroll up and down through the detected DS78V devices, with an underline showing the selected DS78V.

3. The 3rd DS78V shown at Base SW17 uses 16# SW outputs, since it is configured by OPSW's to operate 8 semaphore SW pairs instead of 8 T/C SW turnout controls.

4. The 4th DS78V at Base Sw25 overlaps the 3rd DS78V, and so the 3rd SW base is displayed in RED text, since SW17+16 would require the 4th DS78V SN9945 to have a base address of *at least* Sw33 to avoid SW# overlaps. It shows just SW25.

5. Rotate the DT602 LH encoder knob to underline the 4th DS78V line entry after the RED collision marked 3rd DS78V.

6. Press the numbers 3 then 3 then press the soft key "Chng Adr" , A. The 4th DS78V will change to Base SW33. The 3rd DS78V info now shows all GREEN because there are now no SW overlaps of DS7x devices after it. This "Chng Adr" to 33 for the 4th DS78V Base SW# just cleared the 3rd DS78V's active SW range (minimum is: 17+16 =33), fixing the problem.

CsRt		Ident
Selecting DS7X device:		
Device:	**Base+Out#**	**SerNo**
DS78V	**Sw0001+8 #**	**9122**
DS78V	**Sw0009+8 #**	**3122**
DS78V	**Sw0017+16#**	**2500**
<u>**DS78V**</u>	**Sw0025+8 #**	**9945**
	DS7x device select: LH knob	
Chng adr		

7. To identify the actual *underlined* fourth physical DS78V on the layout; press the F soft key "Ident" and just this DS78V will blink its ID/OPS/RTS leds for 3 seconds. Press "X" to exit any DT602 advanced mode.

8. This advanced DT602 capability allows you to setup all DS7x family devices, like the DS78V and DS74, in position on a LocoNet layout, quickly and conveniently, even if all devices are initially at factory-default Base SW1.

9. If you are using other types of non-DS7x family Switch control decoders, you will have to note their active SW addresses and manually ensure the DS78V's are configured to not overlap these.

6.2 Reading and Editing a DS78V's routes:
As for section 6.1, using a suitable DT602 plugged into LocoNet, press the; Menu>3>4 keys to enter Route Editor menu. If *any* DS78V is on LocoNet, the DT602 will beep after about one second and show "DS7x" routes at the D soft key position.

1. Press the D soft key to now enter the "Selecting DS7x device:" screen,
2. Rotate the LH encoder knob to underline the DS78V to edit routes for.
3. Now press DOWN the LH encoder knob to read in and display the Routes of the selected DS78V, as shown in adjacent "EDIT DS7X Rt#:" screen.
4. The LH encoder knob now selects a Route# and the RH encoder selects the *black outlined* Entry# to edit. Soft A key will toggle the entry from T to C direction choice. Numeric keys will change the SW# in the outlined Entry position. "Add" soft key allows inserting another entry at current position and "Delete" will remove the current entry. The "SW test" soft key will send just the outlined switch# and direction to LocoNet.

```
  CS Rt  │  SW test  │   Delete
EDIT DS7X Rt#:   01  of 16
Entry# TOP of 8

0100c
0224t




DS78V    Sw0009+8  # 3122
DS7X Edit: LH knob selects
 Thrown  │   Add   │   Save
```

5. <u>After edit of any Route is complete **be sure** to press the "Save" soft key to update this DS78V Route to non-volatile memory.</u> Press "X" to exit.
6. With LocoNet connected DS78V routes have System wide control ability.

6.3 Programming DS78V CVs on LocoNet:
As for section 6.0, with a suitable DT602, press the; Menu>2>1 keys to enter Operations Mode programming.

1. Press the F "SWITCH" soft key to enter the "**Ops Switch**" mode programming screen as shown adjacent. This example screen shows CV11 selected for a DS78V with *BASE address of SW1*.
2. Use the LH and RH encoder knobs to select the SW#/ADR of the DS78V to modify a CV on. A DS78V's CV11 to CV15 access the 40 OPSW bit settings.
3. For example; press the "CVDATA" soft key at CV11 to change to CV data entry, press the number 6 then press "WRITE". This now configures the 8 OPSW bits of CV11 to 6, forcing this DS78V to change to semaphore mode with eight 3-position outputs. A value of 02 in CV11 sets default 2-position mode.
4. Be careful changing the values in CV11,12,13,14 and CV15 since the 8 bit data number 0-255 in these CV's actu-

```
            │          │  LOCO
CV Program Menu A:
 Ops Switch ADR: 0001


 CV Number:  0011

   CV data:  0000




 CVNUM  │  CVDATA  │  DONE
```

ally each control 8 individual OPSW bits. OPSW1 is ls bit of CV11, through OPSW8, as ms bit of CV11.

5. The DT602 does not indicate to the DS78V when programming is complete. After *finishing* CV changes, best practice is to POWER cycle the DS78V to save changes. Alternately, you can WRITE CV7 to 00 to restart that DS78V.

7.0 Set up Notes:

1. The DS78V manages servo supply voltages at 5V.
2. In all output modes a 300mA /12 to 14V DC supply should suffice.
3. Using DigiIPL II version 2.9.1 or later on a PC will display a Sub-version number that confirms the last downloaded IPL/update#, since the DS78V does not have a LCD display to show this last IPL download info
4. The OTA and OTB screw terminals are connected to TKA and TKB wires and allow DCC track feed wires to daisy-chain between multiple DS78V's.
5. A connected DSXCP1 will flash red/green while its servo is moving.

Regulatory Information Declaration of Conformity: "This device complies with part 15 of the FCC Rules for a Class B digital device. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation."

These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one of the following measures: Reorient or relocate the receiving antenna. Increase the separation between the equipment and receiver. Connect the equipment into an outlet on a circuit different from that to which the receiver is connected. Consult the dealer or an experienced radio/ TV technician for help

8.0 Warranty & Repair

Digitrax gives a one year Warranty against material and manufacturing defects on the DS78V.

Visit www.digitrax.com for instructions for returning items for repair. **Please return warranty items directly to Digitrax** - DO NOT return items to place of purchase.

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DS78V

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