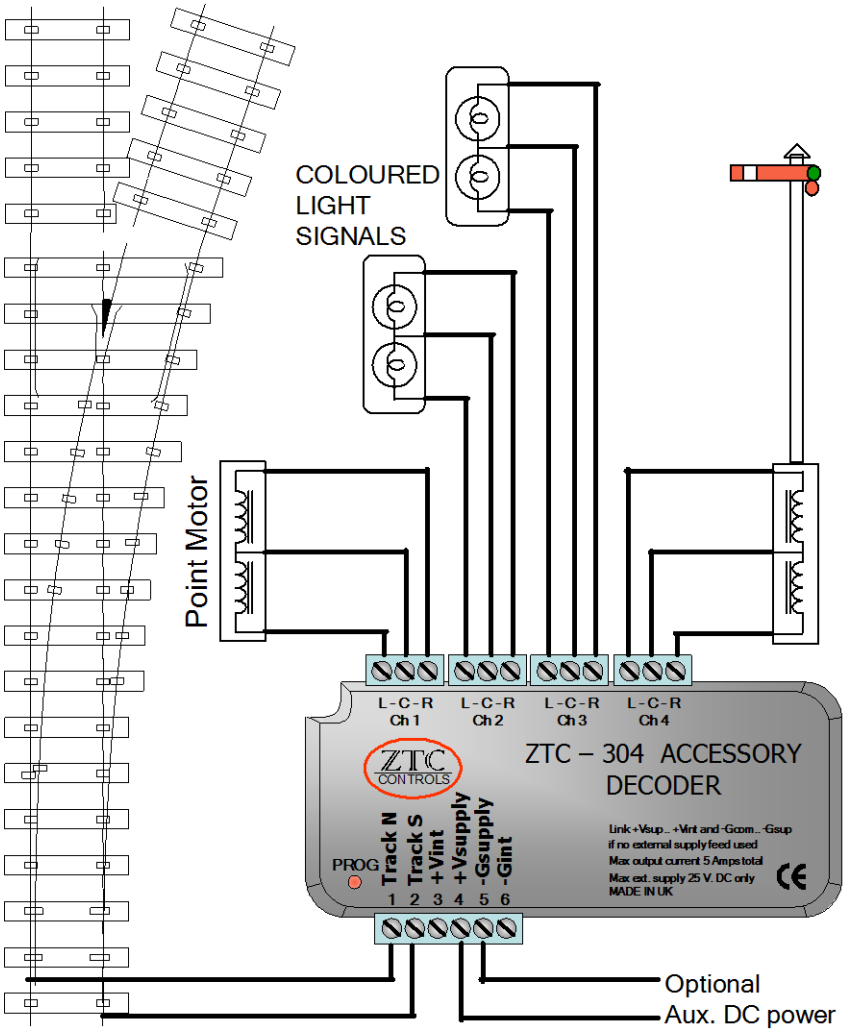
7.0 Accessory Decoders

In addition to locomotives, line side features such as points, signals and other electrically operated devices, can be activated from the controller keypad. To do this, accessory decoders are used to decode the command signals and operate the devices as required. The command signals for accessory decoders are transmitted along the track feed, just like those for locomotive decoders.

Each accessory is assigned a unique address. An accessory decoder address is transmitted in a different way to locomotive addresses and therefore can use the same basic numbers as locomotives (1 - 127) without causing any interaction. The actual range, however, is greater and accessory addresses can range from 1 to 2047. ZTC Accessory Decoders can be operated by any NMRA-DCC compatible controller.

7.1 ZTC 304 and ZTC 305 Features



The ZTC 304 has power output drivers capable of direct operation of large solenoid point motors drawing up to 8 amps. The ZTC 305 will drive loads up to 0.5 amps and is more suitable for light signals and other low current applications.

Each of the eight output channels of the decoders can operate one accessory or a light signal. Note: a point motor requires two channels, one for left and the other for right. These functions can be mixed together as each channel can be individually set-up in various ways for momentary action or continuous output. The channels can also be paired for 2 or 4 aspect colour light signalling.

7.2 Where to Locate Accessory Decoders on your Layout

The decoder is generally designed to be screwed underneath the layout baseboard. It could however be located in a line-side building or some other top-side feature to disguise it. It is important to locate it near to the point work and CDU (Capacitor Discharge Unit) as possible and it is recommended that the maximum wire length is 0.5 m and the minimum conductor of 1.5mm should be used.

If used outdoors, it must be protected from moisture and water ingress. This can be achieved by installing the decoder in a waterproof plastic box or other sealed enclosure. Alternatively, after an operating session, unplug it from its connections and move it to a dry place.

7.3 Power Options

The power required to operate accessories can be taken either from the normal track feed, or from a separate power supply. In both cases the accessory decoder still needs a connection to the track feed to receive command signals. If solenoid point motors are to be operated using the normal track feed supply, then the controller output voltage needs to be set to a minimum of 16 volts. See the ZTC 511 or 505 DCC Controller manual, section 4.0, to see how to set the maximum track voltage.

Having a separate power supply is beneficial when several high current devices (such as solenoid point motors) may be operated by the accessory decoders. If these were powered directly from the track feed, then the performance of running locomotives may be affected. This is because the power is being shared between the locomotives and the accessories. Figure 2 shows the details of how a separate power supply can be connected to the accessory decoders.

The power input terminals of the accessory decoders also allow the use of capacitor discharge units (CDU) ZTC 360 in combination with the accessory decoder. These can supply the high momentary peak power needed for point motors whilst keeping the overall power requirement down to a minimum and are highly recommended for reliable operation.

7.4 Command Signal Feed Options

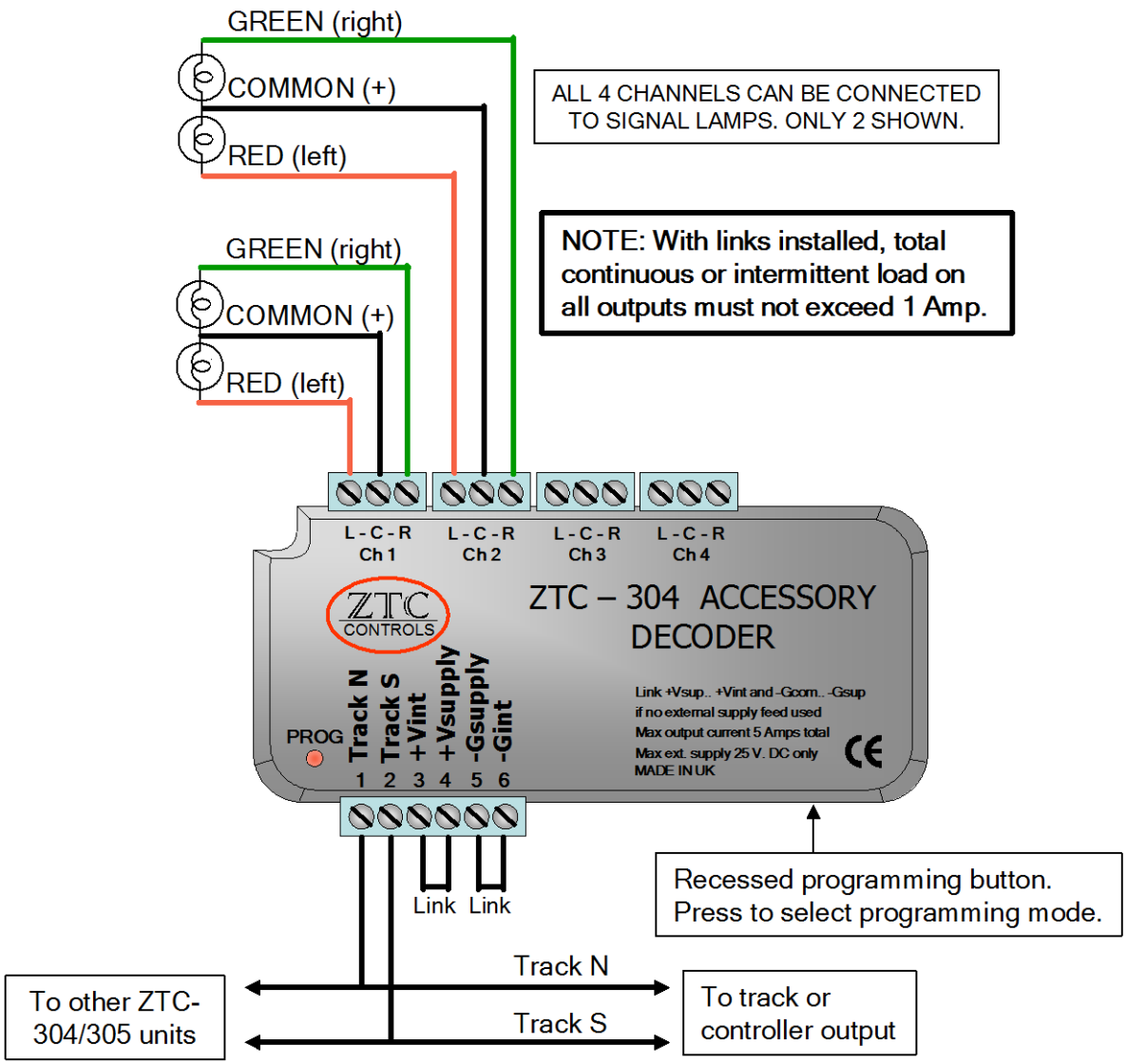
Command signals are taken from the track feed. This means that the signal input connections for the decoders (Track N and Track S) can be connected to a portion of the track bus located close to the decoder. However, to facilitate troubleshooting it is advisable to provide a separate accessory decoder command signal bus to which all decoders are connected. The ZTC 511 or 505 controller has two track feed connections. One can be used to feed the track bus and the other to feed the accessory decoder bus.

7.5 Wiring Connections

All the connections to the accessory decoders are made with plug-in screw terminals. The connection wire used should be adequate for the intended use. For solenoid point motors

use 16 x 0.2mm stranded or 1.5mm solid core wire for connections to the decoder output channel and also the power feed. For lamps, or similar accessories, the size of the wire is less important.
The polarity of the connections to the Accessory Decoder is critical. Refer to the wiring diagrams, figures 1 through 5, for the correct connections.

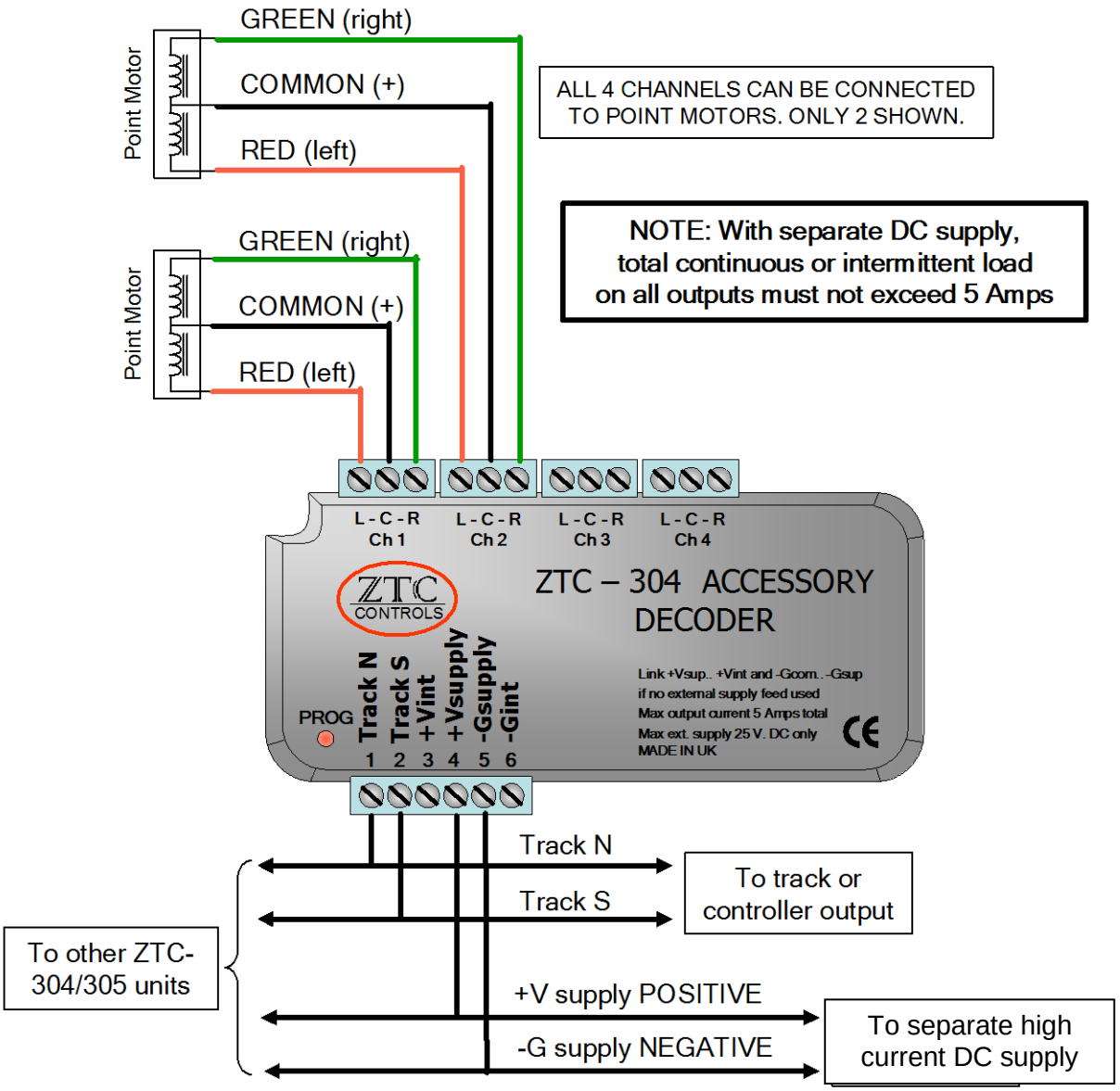
Figure 1 - Accessory Decoder Basic Application



The ZTC 304 or the ZTC 305 can be used to operate low power accessories such as lamps and electric signals. The above figure shows how to connect signal lamps, using the power from the track feed to operate them. The links are required to route the power from the track feed to the accessory circuits. The lamps can be replaced with light emitting diodes (LEDs) and the associated resistors. See Section 2.3.3 for more details on LED circuits.
CV 5 identifies channel 3 – while ***New Value 0*** tells the decoder to provide a continuous voltage output

Solenoid Motor Control (2 solenoids – Peco, Seep, H & M)

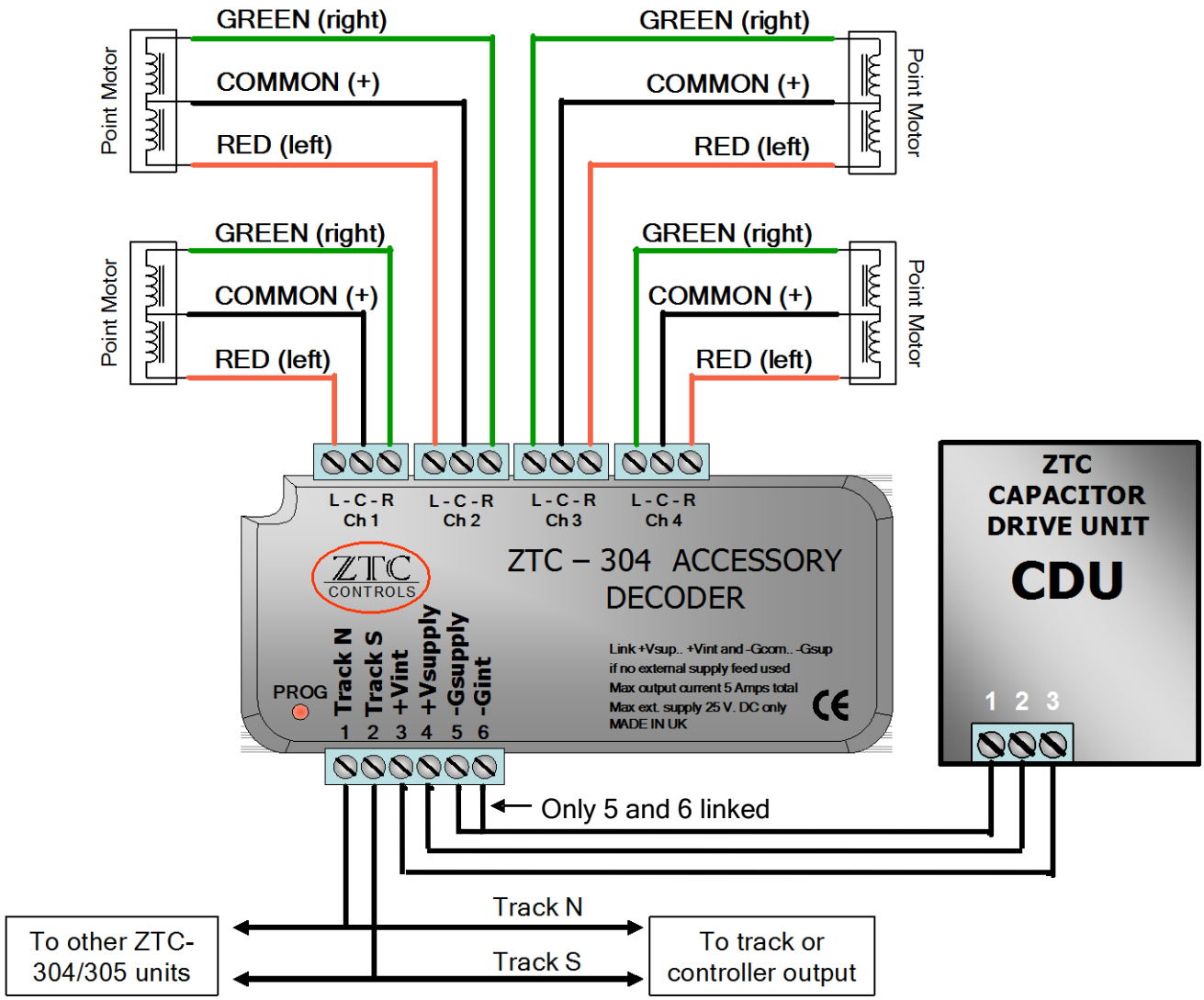
Figure 2 – Connecting Solenoid Point Motors with Separate Power Supply



For solenoid point motors the ZTC 304 must be used. It is also recommended that, if a capacitor discharge unit is not available, an external regulated high current DC power supply must be connected to reduce the load on the track feed voltage. The external power must be regulated DC only.

Note : There are <u>NO</u> links joining terminals 3 to 4 and 5 to 6.

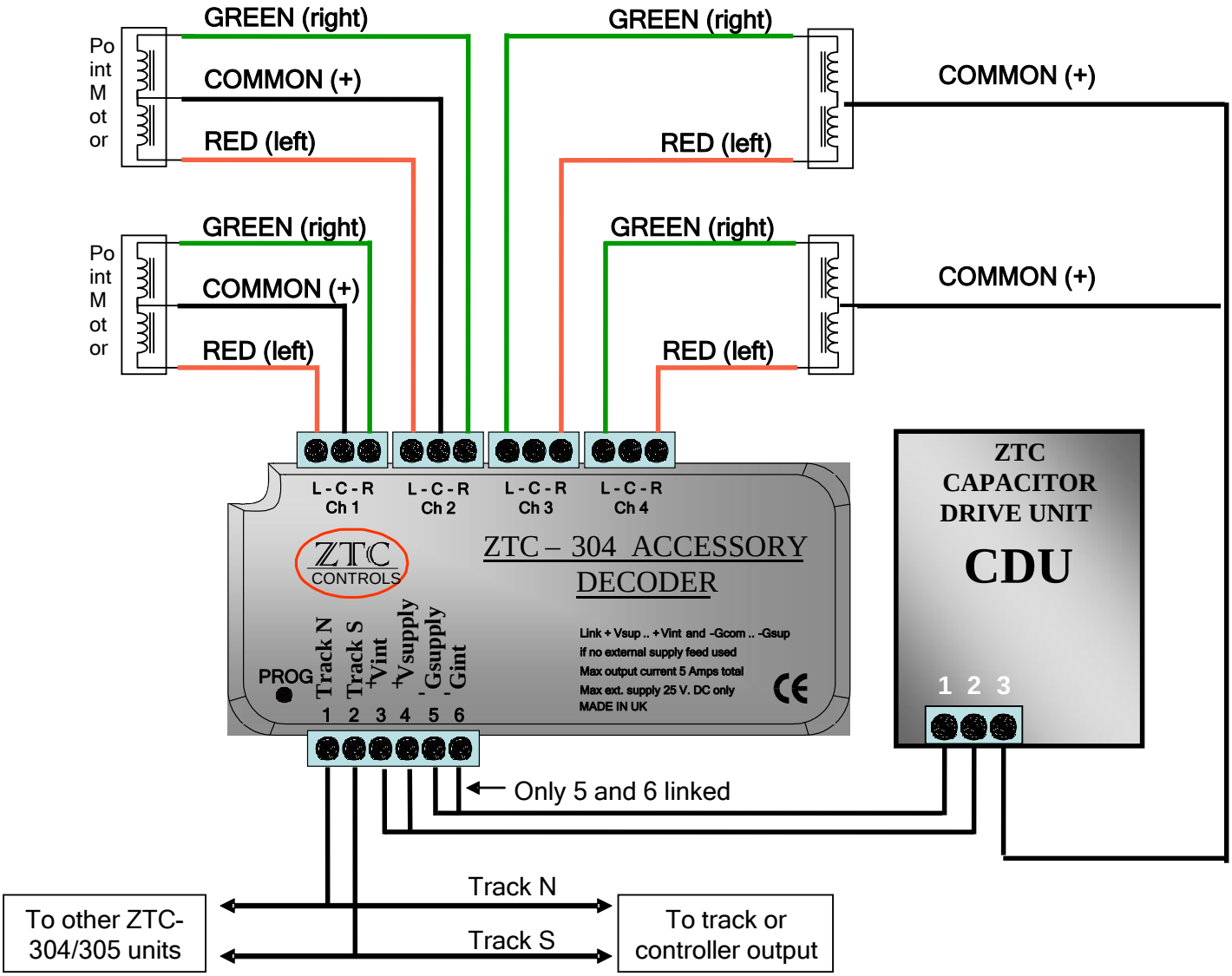
Figure 3 – Operating Solenoid Point Motors Using a Capacitor Discharge Unit (CDU)



Using a capacitor discharge unit (CDU) allows solenoid point motors to be powered from

the track feed. This is less taxing on the track feed power compared with operating point motors directly. A CDU uses the track feed voltage to charge a capacitor. The current required to charge the capacitor is much less than that required to operate the point motor directly. The energy is stored in the capacitor and, when required, is discharged into the point motor. This gives a sudden kick of energy to the point motor, providing a more positive and reliable action. A CDU also minimizes the risk of point motor burn out.
It is recommended that the track feed voltage be at least 16 Volts. If you are using the ZTC 511 or 505 DCC controller, see the controller manual, for details of how the voltage can be adjusted.
Note that a single CDU should be connected to each accessory decoder.

Figure 4 – Mixing Lamps and Point Motors with a CDU



A CDU can be used on just one channel of the decoder if only one point motor is required to be operated. Figure 4 above shows two point motors and two sets of light signals being powered through one decoder. Any combination of these can be used. Note that in this example the common terminals of the point motors are connected to the positive output terminal of the CDU, instead of the common connections on the decoder. The links on the decoder are used to route the track power to the input of the CDU.

Setting CVs for a momentary pulse, suitable for double solenoid point motor operation. (Peco , Seep , H & M)

PRESET → **SIGNAL** → ***cv number*** → **PRESET** → ***new value*** → **ENTER R**

Setting a value greater than 0 (zero), usually between 3 and 25, in the CV will provide a momentary pulse, suitable for solenoid point motor operation. For each increase in value of one, the duration is incremented by 0.02 seconds.

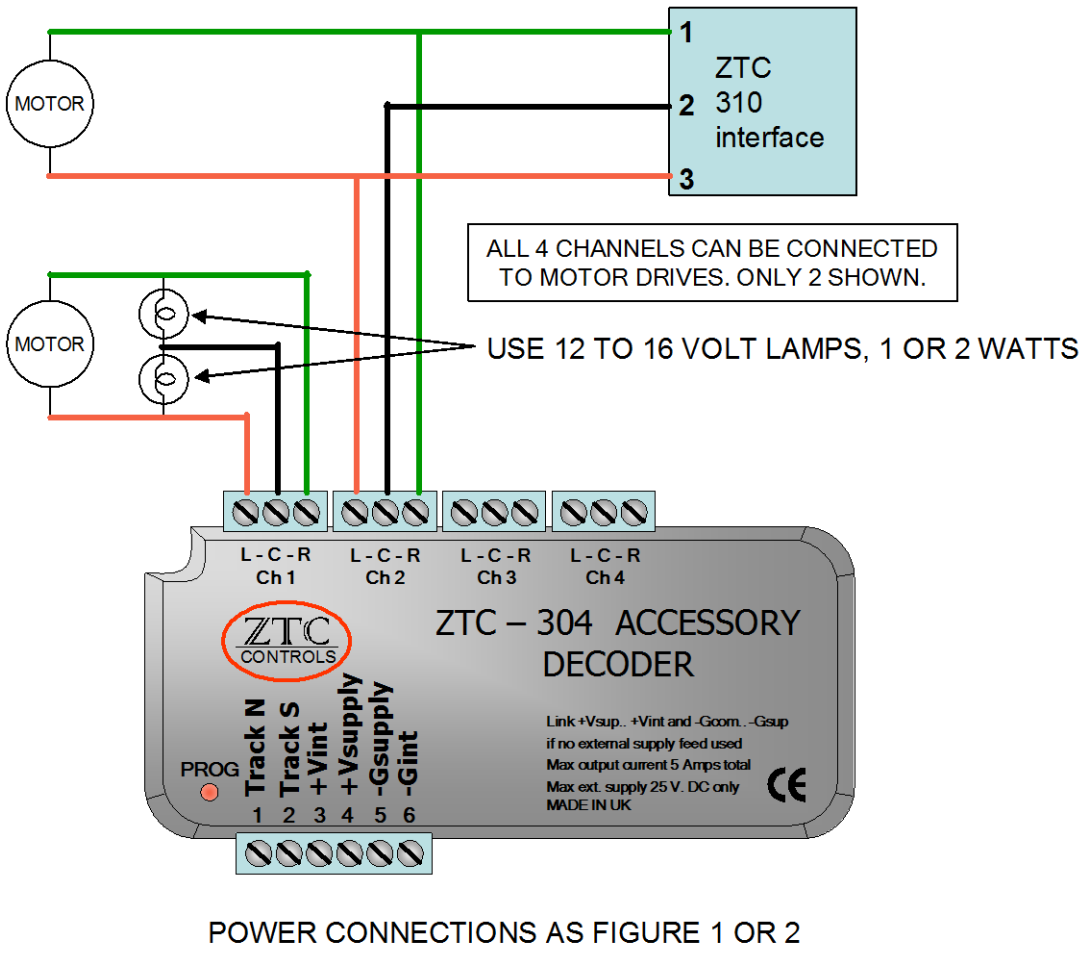
304 / 310 CHANNEL NUMBER	CV NUMBER	DESCRIPTION	NEW VALUE	Notes
1	3	Output channel Time ON	N*	N x 0.02 Sec's = Duration of pulse
2	4	Output channel Time ON	N*	N x 0.02 Sec's = Duration of pulse
3	5	Output channel Time ON	N*	N x 0.02 Sec's = Duration of pulse
4	6	Output channel Time ON	N*	N x 0.02 Sec's = Duration of pulse

For example : To give channel 2 a 0.5 second pulse you would press :-

PRESET → **SIGNAL** → ***4*** → **PRESET** → 25 → **ENTER R**

The ***CV*** '4' identifies channel 2 , while
the ***New Value*** '25' equals 0.5 of a second (25 x 0.02 sec= 0.5 second)

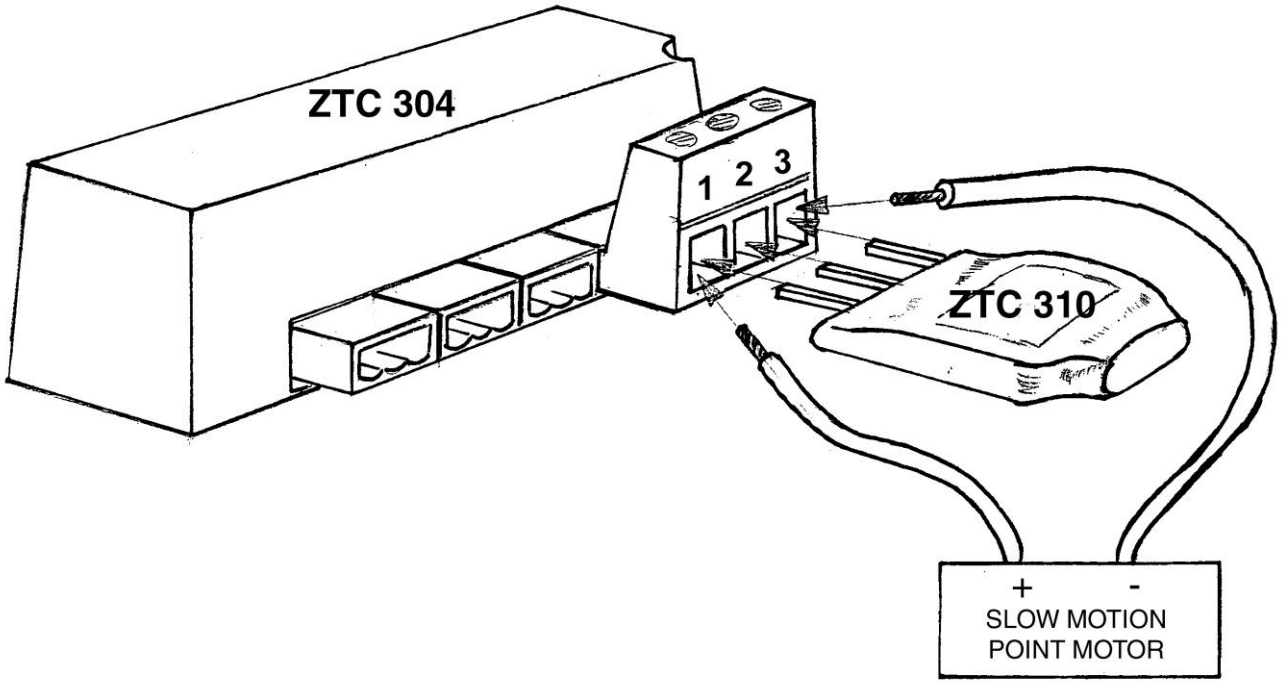
Figure 5 – Slow Motion Point Motor Drive



POWER CONNECTIONS AS FIGURE 1 OR 2

Slow motion point motors (e.g. Tortoise, Fulgarex etc.) can be operated from a ZTC 304. There are two connecting methods. The circuit connected to channel one in figure 5 has two lamps which act as a potential divider providing a quasi common return. This allows the motor to see the reversing voltage polarities required for it to change directions.
The second method uses the ZTC 310 interface. This performs the same function as the lamps in the previous example, but is far more efficient and convenient to connect. See figure 6 for connection details.

Figure 6 – Connecting a Slow Motion Point Motor using the ZTC 310



One end of the ZTC 310 has 3 pins for connecting to the accessory decoder. The pins are spaced to fit in the existing screw terminals on the accessory decoder plug. This makes installation extremely simple.

1. First slacken off all the screws in the plug of the selected ZTC 304 channel.

2. Insert the ZTC 310 fully into the connector, label uppermost, and fully tighten the middle screw only. (Pin 2 on the ZTC 310)

3. Prepare the wires on the point motor with 5mm of copper showing and insert one in the same terminal as Pin 1 on the ZTC 310 and the other into the same terminal as Pin 3. Fully tighten both screws. (Note:- It is easier to insert the wires below the pins on the ZTC 310 rather than above).

4. If the direction of movement of the motor is incorrect for your turnout (point) then the two wires can be changed over to reverse the motor's direction of travel.

The maximum continuous current for ZTC 310 is 1.0 Amp. The maximum momentary current is 2 Amps for 1 second.

Before programming an accessory decoder it is useful to make up a test circuit similar to that shown in Fig. 1, section 7.5 using 4 three way connectors and 8 12volt bulbs. Insert the connectors into the output sockets of the ZTC 304 or ZTC 305 decoder. The result of experimenting with various CV settings can be observed. After your experimentations the decoder can be reset to factory default by following the instructions in section 7.8.

7.6 Accessory Decoder Addresses

In order to send commands to the right accessory decoder, they must each be assigned a unique address number. Once the address has been set up, other parameters for a specific accessory can each be set. This set up is retained by each accessory decoder, even when disconnected from the power.
The number range to identify each accessory output device, whether a point, signal or anything else, can be in the range 1 to 2047 and will not conflict with any loco addresses of the same number.

7.6.1 Accessory Decoder Address Numbering Rule

Most accessory modules, such as the ZTC 304, have four output channels. Each accessory module is assigned a base address, which determines the addresses for each of its four output channels. The value of a base address must comply with the following rule:
Start with a number that is a multiple of 4.

Examples: 4, 8, 24…….480….2032

Then, if you subtract 3 from that number you will get a valid number for a base address. For the examples shown, the valid base addresses would be 1, 5, 21…….477…..2029. The addresses for each of the four output channels are then determined as shown in the following examples:

Base Address Examples	Output Channel Addresses
1	1, 2, 3 and 4
5	5, 6, 7 and 8
21	21, 22, 23 and 24
477	477, 478, 479 and 450
2029	2029, 2030, 2031 and 2032

Base addresses do not have to be sequential. In other words, if you assign base address number 1 to your first accessory decoder, your second decoder can have any other base address; it does not have to be 5.

7.6.2 Setting an Accessory Decoder Address

The ZTC 304 and ZTC 305 come already set with a base address of 1. That is, with addresses 1, 2, 3 and 4 for each of the four channels. The default address will have to be changed if more than one accessory decoder is to be used on your layout. The following method for changing the address is known as the Address Capture Method. Stop all trains running, and remove them from the track, or if you have a separate accessory signal bus, just unplug the track connection to the controller. This eliminates the risk of inadvertently programming loco modules. Briefly press the programming button found on the side of the accessory decoder (see figure 1). This puts the decoder into programming mode. This is confirmed by a flashing red light. Set the base address by keying in:

SIGNAL → ***base address*** → **ENTER R**

The accessory decoder will show acceptance of the new address by the RED light staying on for a few seconds. Briefly press the programming button once more to exit programming mode. Alternatively, if you are using the ZTC 511 or 505 controller, you can press the ALL STOP button twice. This kills power to the accessory decoders, resetting the programming mode. Power is then restored by pressing the CLEAR button.

Note: All ZTC 304 and ZTC 305 accessory decoders purchased before 1st November 2003 will have a factory default address of 41. This bought after this date will have a factory default address of 1.

7.7 Programming an Accessory Decoder Configuration

Just as loco modules have configuration variables (CVs), accessory decoders also have CVs. The value in the CVs determines if a decoder is set up to operate solenoid type devices (some point motors), which require a momentary output, or continuous output devices such as lamps, signals etc.
Note: Ensure that decoder outputs are not connected to any device until you are sure that the correct CV setup is programmed for the device in question.

To set an accessory decoder CV key in :

PRESET → **SIGNAL** → ***cv number*** → **PRESET** → ***new value*** → **ENTER R**

Where ***cv number*** is the CV number (1 to 64) and ***new value*** is a number (0 to 255).

Note that CV 1 (decoder base address) is best programmed using the method already discussed in Section 7.6.2.
A list of important accessory decoder CVs and ranges of values can be found in the table in Section 7.7.2.

Only the channel timers CVs 3, 4, 5 and 6 absolutely need to be considered for set-up. These determine if you have signal lamps (continuous output) or a point motor or other solenoid operated accessory (momentary output) connected to a particular channel. The other CVs should only be set with careful consideration to the accessory operation.

When supplied, the decoder is set up for momentary operation on all 4 channels to facilitate connection to solenoid point motors.

7.7.1 Accessory Decoder CV's and their Function

The following information describes the various CV's in detail.

Output Timers - CV's 3, 4, 5, 6
These CV's set the length of time that the output for each channel is in an ON state.
Note that each of the four paired output channels is individually set

Auxilary Motor Control – continuos voltage ie: point drives (Tortoise , Fulgurex , Lemoco etc) , turntables , cranes , gates , winches etc

PRESET → **SIGNAL** → ***cv number*** → **PRESET** → ***New value (0)*** → **ENTER R**

cv number – This number relates to which channel on the decoder you are setting .

new value - **0** This setting gives a continuous voltage output

304 / 310 Channel Number	CV Number	DESCRIPTION	New Value
1	3	Output channel Time ON	0
2	4	Output channel Time ON	0
3	5	Output channel Time ON	0
4	6	Output channel Time ON	0

These CV's set the length of time that the output for each channel is in an ON state. Setting a value of 0 (zero) programs the decoder to give a constant output, suitable for powering lamps or electric motors. Normally an output channel pair is toggled. That is, when one is on the other is off.

For example : Channel 3 to operate a motor driven point .

PRESET → **SIGNAL** → ***5*** → **PRESET** → ***0*** → **ENTER R**

Output Mode - CV's 41, 42, 43, 44
These CV's allow the output channels to be configured for individual control or for flashing operation.

CV Value	Affect
0 (default setting)	**Normal -** Output channel pair toggled. When one is on the other is off.
1 to 11	**Not allowed -** Will disable both left and right outputs
12	**Momentary**, but with dim output if CV51 to 54 >0. (**must not be used with solenoid point motors**
13	**Flash alternately** – at rate set by corresponding timer CV. Timer CV should be set to a value of 20 to 30 and not less than 2. E.g. Level crossing flashing lights.
14	**Individual control** – Left or right outputs separately controlled. Corresponding timer CV must be set to 0. See Section 8.3 to see how this can be used for multiple aspect signaling.
15	**Individual flashing** – Each output can be selected as flashing. Corresponding timer CV must be set to 2 or greater.

Output Dimmers CV's 51, 52, 53 54
If the decoder output channels have been set for continuous output, then four output levels can be achieved. For lamps this means four brightness levels. The values 0 through 3 entered into the CV provide the four brightness levels, with 0 being the brightest . Values of 4 or above are not effective.

The decoder achieves the dimming by pulsing the output at a variable mark/space ratio. The lamps should be of the correct voltage for the external supply or be capable of operation from 18 Volts if the internal power option is used.

Dropping resistors should be used in series with each lamp if they are rated at less than the supply voltage. The value and power rating of such resistors would have to be determined by experiment and calculation.

Power Up State CV's 31, 32, 33, 34
Each of these CV's controls the power-up state of each channel. They only apply to those outputs set for continuous output, i.e.: the relevant Timer CV set to 0. Normally for the default (when set to 0), the outputs' last commanded state will be recalled when the unit is powered up.

By setting the appropriate CV to a value of 1, the output will always power-up in the OFF state. By setting it to 2 the output will always power-up in the ON state

The operation of this CV is ignored if the output has been configured for momentary operation, e.g. for a solenoid point motor.

7.7.2 Table of Accessory Decoder CV's

CV NUM	DESCRIPTION	Default (N)	MIN	MAX ZTC	Notes
3	Channel 1 Output Time ON	5	0	255	0 = No timer, N x 0.02 Sec's
4	Channel 2 Output Time ON	5	0	255	0 = No timer, N x 0.02 Sec's
5	Channel 3 Output Time ON	5	0	255	0 = No timer, N x 0.02 Sec's
6	Channel 4 Output Time ON	5	0	255	0 = No timer, N x 0.02 Sec's
31	Chan 1 Output Power-up state	0	0	2	0 = normal as before 1 = off 2 = on
32	Chan 2 Output Power-up state	0	0	2	0 = normal as before 1 = off 2 = on
33	Chan 3 Output Power-up state	0	0	2	0 = normal as before 1 = off 2 = on
34	Chan 4 Output Power-up state	0	0	2	0 = normal as before 1 = off 2 = on
41	Chan 1 Output Mode	0	0	15	0 = normal 13 = flash (if CV 3 set >0) 14 = individual control 15 = individual flashing
42	Chan 2 Output Mode	0	0	15	0 = normal 13 = flash (if CV 4 set >0) 14 = individual control 15 = individual flashing
43	Chan 3 Output Mode	0	0	15	0 = normal 13 = flash (if CV 5 set >0) 14 = individual control 15 = individual flashing
44	Chan 4 Output Mode	0	0	15	0 = normal 13 = flash (if CV 6 set >0) 14 = individual control 15 = individual flashing
51	Chan 1 Output Brightness or power	0	0	3	0 = normal, 1 = ¾ 2 = ½, 3 = ¼
52	Chan 2 Output Brightness or power	0	0	3	0 = normal, 1 = ¾ 2 = ½, 3 = ¼
53	Chan 3 Output Brightness or power	0	0	3	0 = normal, 1 = ¾ 2 = ½, 3 = ¼
54	Chan 4 Output Brightness or power	0	0	3	0 = normal, 1 = ¾ 2 = ½, 3 = ¼
1	Base Address of Accessory decoder (low)	1	1	63	Split address set automatically by Address Capture Method. See Section 7.6.2.
9	Base Address of Accessory decoder (high)	0	0	15	

7.8 Decoder Reset

The ZTC 304 and ZTC 305 accessory decoders can be reset to factory default using the following sequence.

1. Set the accessory decoder to the program mode by pressing the concealed push button on the side of the module.
2. Press the following buttons in sequence.

   CLEAR → **PRESET** → **SIGNAL** → **9** → **9** → **ENTER R** → **ENTER R**

3. On completion of the display sequence press the Red button on the ZTC 511 or 505 twice. Your decoder is now reset.

Note: If you are using ZTC 511 V4.01 or greater then channel 1 will be set to number 1.
If you are using ZTC 505 V1.00 or greater then channel 1 will be set to number 1
If you are using ZTC 511 V3.01 or lower then channel 1 will be set to number 41.