TWO ASPECT SIGNALS & AUTOMATION

In a two speed signal system there are only two aspects to deal with. If the block ahead is occupied, the signal is RED and the train should stop. With the block ahead clear, the signal is GREEN and the train can proceed. It is possible to do both signals and automation with the relay contacts available on the DALLEE ELECTRONICS TRAK-DT (Item 365).

Each signal block must have a TRAK-DT for detection and at least one rail electrically insulated for the full length of the block. The wire that feeds electrical power to the insulated rail is passed through the detection coil of the TRAK-DT. When a train (locomotive, lighted car or anything that draws electrical current) is getting its power from the insulated rail the TRAK-DT will activate its (double pole double throw) relay contacts. Each block will also need an insulated rail section where power can be disconnected so that a train can be stopped if the signal is RED. As a convenience it is a simple matter to provide detection on the left rail and power selection on the right rail.

The beginning point of detection in a signal block should be at least one locomotive length past the actual signal location and the stopping area for automation should begin a full locomotive length prior to the signal. The actual dimension of a locomotive length will depend on operating practice. Key dimensions are the length of your longest steam locomotive and tender combination and/or the length of multiple unit diesel sets.

In operation, as a train goes past the signal and is detected, the signal turns RED and the stopping area of track prior to the signal should have no power so that an approaching train will stop. It is not possible to merely shut off the power to this track section as we must maintain continuous current flow so the TRAK-DT devices will function properly. Track power is connected to the normally closed terminal of one contact set and to the running area of the block. The common terminal connects to the stopping section of rail. A ballast lamp is connected between the open and closed terminals of this contact set so that when the relay is activated the lamp is in series with the stopping section. If a KEEP-A-LIVE (Item 588) device is installed on the throttle, then a capacitor (0.1 mfd or larger non-polarized) can be used instead of the ballast lamp.

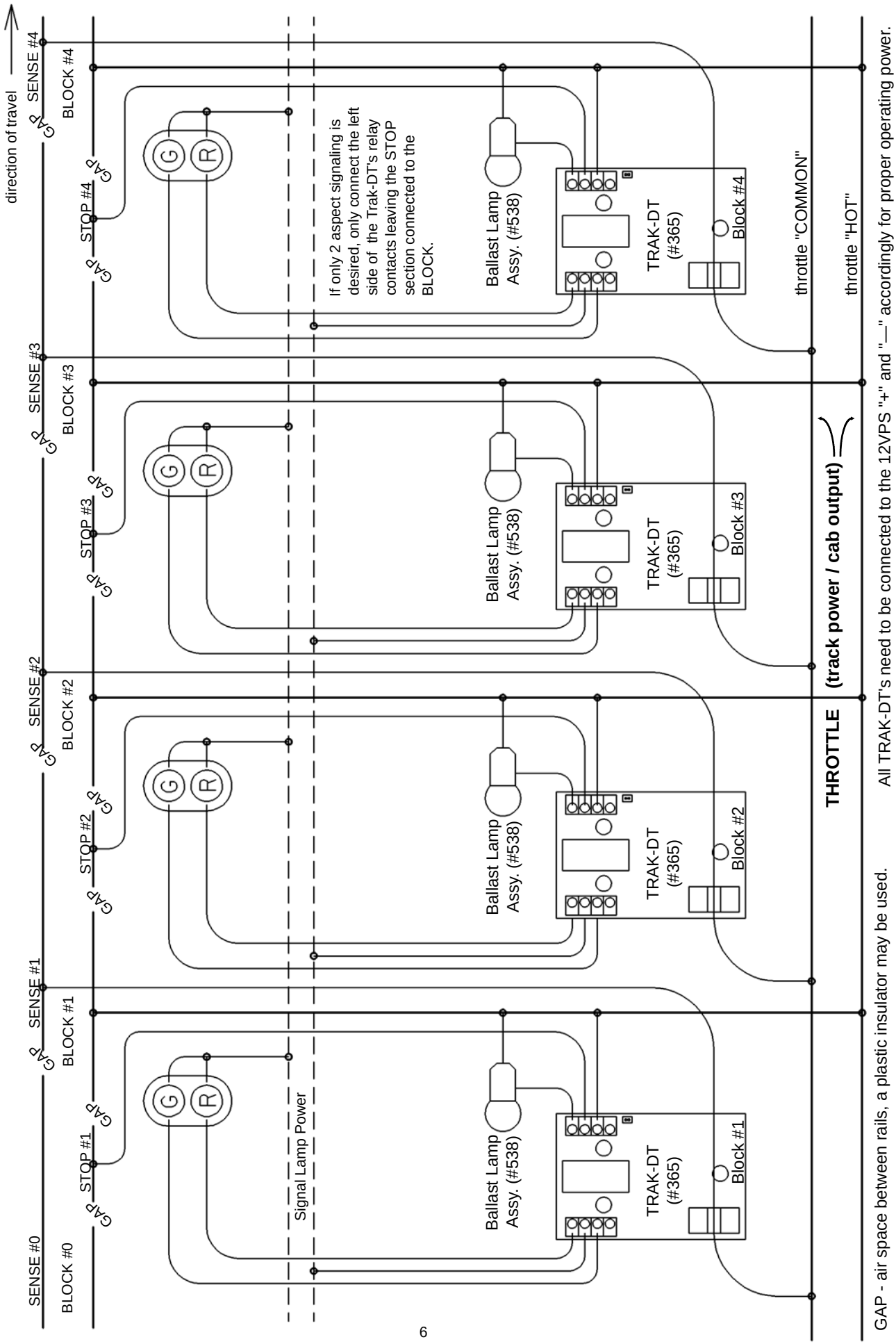
Power for the signals comes in to the common terminal of the other contact set of the relay. The normally open terminal is connected to the RED indicator and the normally closed terminal is connected to the GREEN indicator. When the train is detected the relay on the TRAK-DT is activated. One contact set switches signal power to the RED indication and the other contact set connects the ballast lamp in series with track power going to the stop section of rail. The ballast lamp will shunt power so that a locomotive in stop section will not run but current flow is maintained. With KEEP-A-LIVE devices installed, the capacitor will block the DC track power from reaching the stop section so a locomotive will not run. The KEEP-A-LIVE signal will pass through the capacitor to the stop section providing the maintenance of current flow. When the block is cleared the relay on the TRAK-DT relaxes switching signal power to the GREEN indicator and full track power back to the stop section of rail.

While the above discussion has been based on two rail DC applications the two speed automation is also possible with AC or with three rail layouts running either AC or DC. All sequence reversing (E-UNITS) devices on the locomotives must be locked or disconnected so the locomotive will run only in one direction. In a three rail system it is necessary to gap both of the outside "ground" rails. Again the rail gaps should be located one engine length beyond the signal location. Power selection is then made on the center rail with its gaps cut prior to the signal location. DC should be wired with the "plus" on the center rail and "minus" to the two outside rails. AC should always be wired so that transformer "hot" is on the center rail and base post "ground" connects to the two outside rails.

The one exception to the choice of detecting on the "ground" rails is if LIONEL track switches are employed on the automated loop. These switches use the "ground" rails to provide non-derailing features and for the light bulbs. If LIONEL switches are in use then detection should be done on the center rail and power selection done on the "ground" rails. In this circumstance the power for the switch lamps must come from the fixed voltage plugs so that the lamps are isolated from the center rail.

The following pages cover basic operation with just signals to that of full automation. Complexity grows when opting for east / west operations along with multiple locomotives used in one train. For multiple locomotives, it is necessary for the lead locomotive to enter the stop section for the signal. Then the rest of the locomotives must also have their power removed, hece the necessity for the second detector. This detector basically makes the stop block grow to a longer block covering all of the locomotives in the consist.

TWO ASPECT SIGNALS with stop block for automation



GAP - air space between rails, a plastic insulator may be used.

All TRAK-DT's need to be connected to the 12VPS "+" and "—" accordingly for proper operating power.

THREE ASPECT SIGNALS & AUTOMATION

Stated in simple terms, THREE ASPECT SIGNALS say that if the block ahead is occupied the signal is RED and you must stop. If there is one clear block ahead, the signal is YELLOW allowing a reduced speed. Normally this YELLOW or restricted aspect includes the order---prepare to stop at the next signal (it is probably RED if there is only one clear block ahead). With two or more clear blocks ahead the signal is GREEN allowing normal speed.

A single signal head displaying all three aspects provides a simple method of speed limiting. By combining several aspects, usually through the use of multiple heads, information other than speed can be displayed. This is frequently done at junctions (interlocks) where the HOME SIGNAL is indicating both speed and routing. How extensive the variations of these multiple aspects are is dependent upon the operating rules of each individual railroad.

THREE ASPECT SIGNALS are easily modeled using DALLEE ELECTRONICS TRAK-DT devices. Each signal block must have a TRAK-DT for detection and at least one rail electrically insulated for the full length of the block. The wire that feeds electrical power to the insulated rail is passed through the detection coil of the TRAK-DT. When a train (locomotive, lighted car or anything that draws electrical current) is getting its power from the insulated rail the TRAK-DT will activate its (double pole double throw) relay contacts. These two sets of contacts are then used to illuminate the appropriates signal aspect. When the relay is activated one contact set is used to illuminate the RED aspect. This same contact set can, at the same time, be used to illuminate occupancy indicators on a control or display panel if the indicators are the same type of lamp or LED as the signals. If the relay is not activated (block clear) the signal can be either YELLOW or GREEN depending upon the situation at the next ahead block. The second contact set of the relay of the next ahead TRAK-DT is used to illuminate the YELLOW or GREEN aspect as appropriate.

Circuitry for the signal aspects is interconnected between the contact sets of the relays. Signal illumination power inputs at the common terminal of the first contact set. The RED aspect is connected to the normally open terminal of this set. When the relay activates, signal power goes to the RED indicator. With the relay relaxed, signal power is switched to the normally closed terminal of this contact set which is connected to the common terminal of the second contact set of the next ahead TRAK-DT relay. If the next ahead relay is activated (one clear block) signal power goes to the normally open terminal of the second contact set and therefore to the YELLOW indicator. If the next ahead relay is relaxed (two or more clear blocks) signal power switches to the normally closed terminal of the second contact set and thus to the GREEN indicator. If signals are desired in both directions on a single track, this can be accomplished with only one TRAK-DT per block, however two additional sets of relay contacts are required. Two sets of contacts operate the signals in one direction and two sets of contacts operate the other direction.DALLEE ELECTRONICS product Item 555 RELAY BOARD is a double pole double throw relay mounted on a circuit board with a jumper connector allowing it to be operated with the TRAK-DT. This converts each TRAK-DT into a four pole double throw relay to accommodate both signal directions.

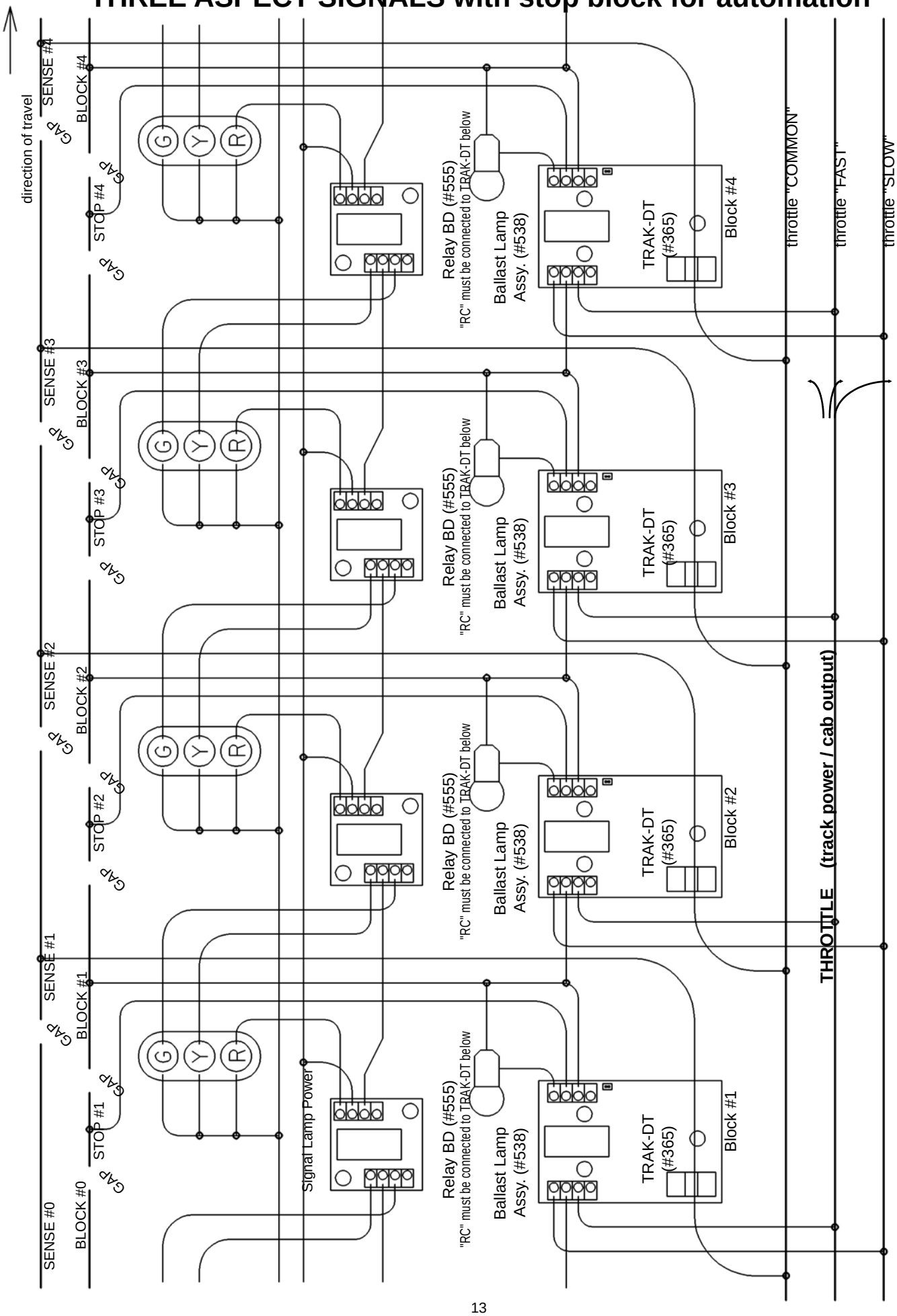
Full automation with THREE ASPECT SIGNALS can also be accomplished with DALLEE ELECTRONICS TRAK-DT devices if ballast lamps or KEEP-A-LIVE devices, two throttles and additional relay contacts are used. THREE ASPECT SIGNALS requires two contact sets of the TRAK-DT and matching automation also requires two contact sets. The RELAY BOARD provides the correct number of contact sets to accomplish both the signal and speed requirements. The ballast lamps or KEEP-A-LIVE will maintain continuous current flow when a train is stopped for a RED signal. One throttle is used for approach speed (YELLOW signal) and the second throttle provides normal running speed (GREEN signal). The extra relay contacts connect either throttle, KEEP-A-LIVE or the ballast lamp to the track as required.

In order to provide more realistic operation there are several suggestions to be given consideration. First, since there can be several trains connected to each throttle at any given time it is suggested that the throttles be of voltage regulated design so that as the load is changed by more or less trains, the output voltage, and therefore speed, remains constant. A second consideration involves the placement of the insulating rail gaps which define signal sections and the stop area for the RED signal aspect. Past experience suggests that the beginning point of detection in a signal block should be at least one locomotive length past the actual signal location and the stopping area for automation should begin a full locomotive length prior to the signal. The actual dimension of a locomotive length will depend on operating practice. Key dimensions are the length of your longest steam locomotive and tender combination and / or the length of multiple unit diesel sets.

It is possible to automate two trains following each other on one track loop, with three aspect signaling, using only five signal blocks but it is suggested that a minimum of six blocks be employed and that each block be as long as the longest train. Additional trains should have two additional blocks each for appearance although an absolute minimum could be one block per train plus four blocks for running. The current carrying capacity of the throttles is probably the major limiting factor in this automation.

If detection is done on one rail and power selection is done on the other rail the whole process becomes rather simple. Suppose that we are going to detect on the left rail. This rail is then "gapped" one locomotive length beyond each signal all the way around the track loop resulting in a section of this rail for each block. Power to this rail originates at the minus (ground) terminals of each throttle which are commoned and then routed through the sense coil of each TRAK-DT to the individual rails. The plus (hot) terminal of the approach throttle is connected to the normally open terminal of the second contact set of the relay of each TRAK-DT and the plus (hot) of the normal running throttle connects to the normally closed terminal of this contact set. The common terminal of the second contact set is connected to the normally closed terminal of the first contact set of the prior TRAK-DT and to the right rail of the track between signals. The common terminal of the first contact set connects to the stopping section which is a "gapped"

THREE ASPECT SIGNALS with stop block for automation



GAP - air space between rails, a plastic insulator may be used.

All TRAK-DT's need to be connected to the 12VPS "+" and "—" accordingly for proper operating power.

TWO TROLLEY CARS ON ONE LOOP OF TRACK

PROBLEM:

Operate two trolley cars on a continuous loop of track where one car is stopped at station while the other runs. As the running car approaches the station the stopped car departs and the running car then stops.

DISCUSSION:

A dead section of track will cause a stop at the station. Briefly energizing this dead section will allow the stopped car to depart from the station. There are two alternatives to this problem. We can have the running trolley hold the stop section "off" until we want the stopped car to depart or we can have the running car turn the stop section "on" for departure. In either case there is a timing decision to be made. In one case the timing is accomplished by changing the length of track on which we need to have detection to keep the stop section "off". In the other situation we can use a time device to determine how long the stop is turned "on".

SOLUTION #1:

If we use a DALLEE ELECTRONICS TRAK-DT to sense the presence of a trolley during most of the track loop, the relay on the TRAK-DT will hold the stop section "off". There must be a stop section of track about one trolley length, a run section long enough for the trolley to escape the stop, then a sense section where the stop is held "off" and finally another run section which will allow the stop section to be energized.

Trolley #1 is stopped. Trolley #2 is running in the 'sense' section. When Trolley #2 passes from the 'sense' section to a 'run' section the TRAK-DT relaxes its relay, powering the 'stop' section. Trolley #1 can now run. In fact both trolley cars are now running. Trolley #1 must get into the 'sense' section so the TRAK-DT will activate its relay and kill the 'stop' before Trolley #2 reaches the 'stop'. The length of this running section is critical to the timing. The 'run'section must be long enough for the TRAK-DT to relax its relay to energize the 'stop' and for the other trolley to get back into the 'sense' section. The faster the trolley runs the longer this section must be. A good starting point for this section length is about 1/4 of the loop.

SOLUTION #2:

If we establish a 'trip' section somewhere between 1/2 and 3/4 of the way around the loop, we can use a TRAK-DTT (adjustable detector mode) on this 'trip' and have the relay turn "on" the 'stop' section for an adjustable time period. Trolley #1 is stopped and Trolley #2 is running. When Trolley #2 reaches the 'trip' section the TRAK-DTT activates its relay turning power "on" in the 'stop' allowing Trolley #1 to escape into the run area. As before, both trolley cars are now running. As soon as Trolley #2 clears the 'trip' and the time frame expires, the TRAK-DTT relaxes its relay killing 'stop' power so that Trolley #2 will stop. The placement of the 'trip' and the time frame adjustment must be such that the 'stop' is "on" long enough for the stopped trolley to escape but turns "off" before the running trolley reaches the 'stop'.

SOLUTION #1 is shown on page 55. SOLUTION #2, as explained above, is similar to SOLUTION #1. SOLUTION #2 would be to merely replace the TRAK-DT with a TRAK-DTT thus allowing for a shorter length 'trip' section (shown as TRIP-A).

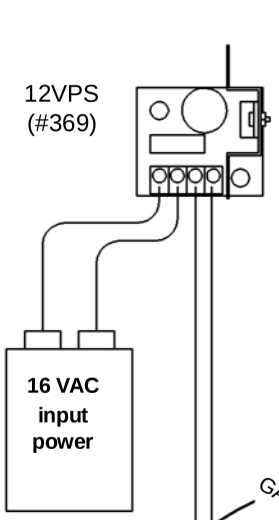
SOLUTION #3:

by using two DALLEE ELECTRONICS TRAK-DT's to sense the presence of both trollies at specific locations a collision can be avoided. The wiring diagram, on page 56, has an operation explanation at the top of the page. The same diagram can be used for two trains. Full protection from collision is not obtained since a train can come uncoupled and not be detected. For full protection you would have to wire as in the full signaling diagrams in the front of this applications guide without the signals connected.

SUMMATION:

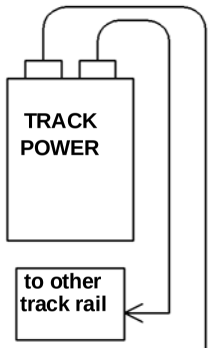
Regardless of the solution used there are only two devices needed to accomplish this automation. First, you must have a 12 volt DC regulated supply (DALLEE ELECTRONICS-12VPS-Item 369) to power the electronics and second, either a TRAK-DT (Item 365) or a TRAK-DTT (Item 565). An AC source of 14-18 volts is needed to power the 12 volt regulator and there must be adequate power in the track to run both trolley cars at the same time.

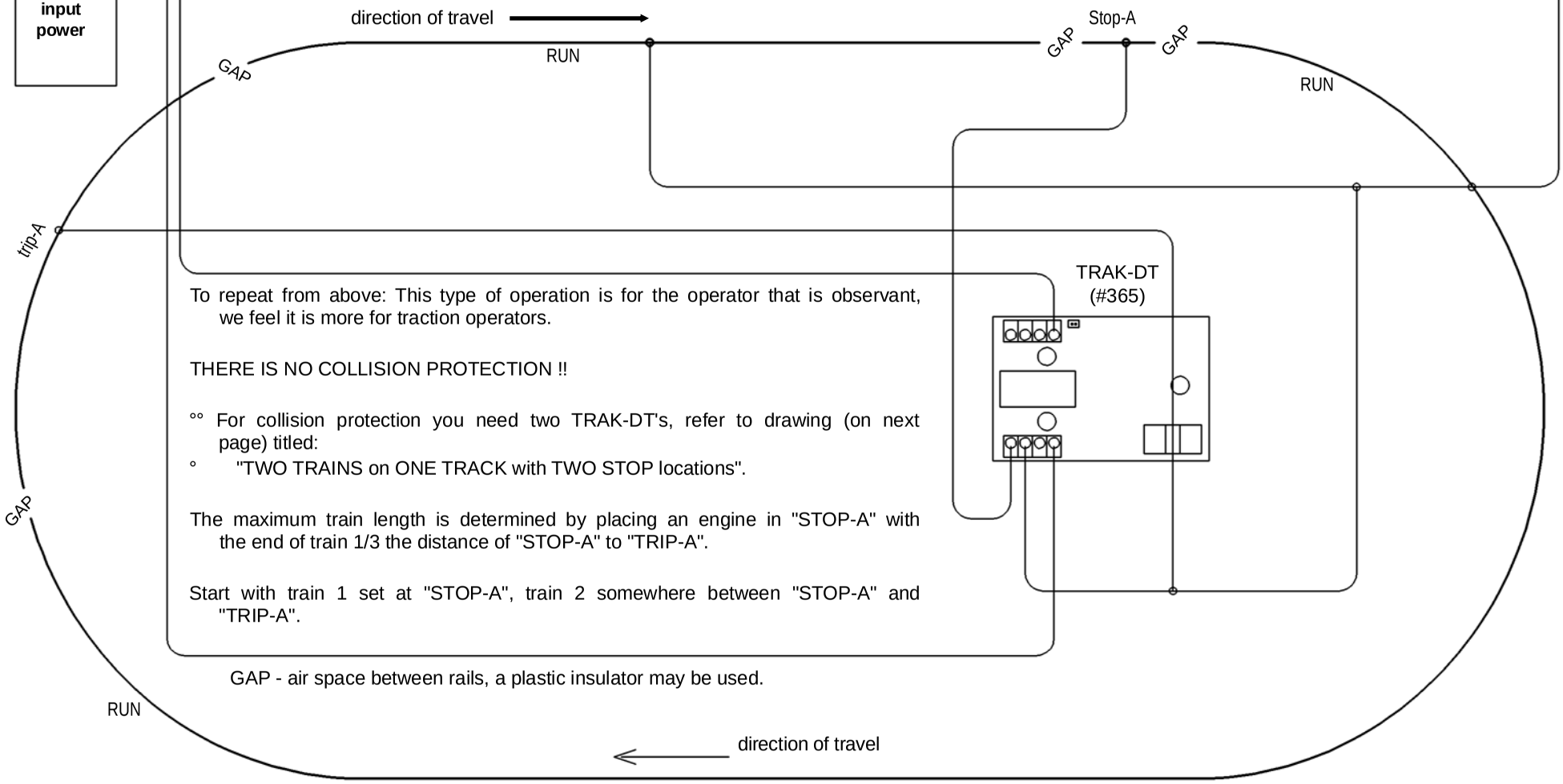
TWO TRAINS on ONE TRACK with ONE STOP location



Operation: With train 1 sitting at "STOP-A" train 2 will proceed to "TRIP-A", releasing train 1 and continue to "STOP-A". THERE IS NO COLLISION PROTECTION !!°° When train 2 gets to "TRIP-A" power is applied to "STOP-A" setting train 1 to proceed into the powered run section. If train 1 does not leave "STOP-A" section then train 2 will collide with train 1. If protection is desired it is necessary to use two TRAK-DT's as shown in another drawing on the next page°. This type of operation is for the operator that is observant, we feel it is more for traction operators (trolley cars).

The stop time is determined by how long the train takes to complete the route from "STOP-A" to "TRIP-A". The STOP sections should be long enough to hold the motive power you are running. If you choose to use multiple engines then they must all have common power pickup between all units (this increases stop lengths). "TRIP-A" needs to be long enough to allow the entire train at "STOP-A" to leave. You may choose to use a "TRAK-DTT" (#565) instead of the TRAK-DT to insure enough time has elapsed. You may also choose to use our "OPTO-DT" (#552 or #553) in place of the TRAK-DT if you do not wish to rely on track current to trip the operation.





To repeat from above: This type of operation is for the operator that is observant, we feel it is more for traction operators.

THERE IS NO COLLISION PROTECTION !!

°° For collision protection you need two TRAK-DT's, refer to drawing (on next page) titled:

° "TWO TRAINS on ONE TRACK with TWO STOP locations".

The maximum train length is determined by placing an engine in "STOP-A" with the end of train 1/3 the distance of "STOP-A" to "TRIP-A".

Start with train 1 set at "STOP-A", train 2 somewhere between "STOP-A" and "TRIP-A".

GAP - air space between rails, a plastic insulator may be used.

TWO TRAINS on ONE TRACK with TWO STOP locations