Installation Tips

An SRE Bulletin on Making Your Installations Easier!

The following instructions lead you through the installation of an SRE controller in a **dual motor vehicle where the motors are installed in parallel with *no* common armature-field connection across the two motors**[1]. These vehicles include trucks that already use a "D" contactor[2] and those that use diodes to control current.

A. DETERMINING MOTOR CONFIGURATION

The most important piece of information is how the motors are connected, not what they do in a turn. The SE325 works with all dual motor configurations. How it is connected and set up depends on the configuration, outlined below

1. Series configuration

- See figure 5 for example wiring
- generally 36 or 48 volt trucks
- armatures may or may not be out of circuit in a turn
- simple configuration, connect as for the single motor case with the addition of the armature switch for turns, if the truck has one
- do NOT use a D contactor. This installation is described in the SE325 installation manual.

2. Parallel configurations

- usually 24 or 36 volt trucks

a) PARALLEL ARMATURE-FIELD CONNECTIONS

- See figure 6 for example wiring
- these motors are completely in parallel
- both motors are always on, one does not cut out
- connect as for single motor case, with one set of direction contactors. See the SE325 installation manual for installation instructions.

b) DIODE

- example: Clark TM series which uses the number 6 recs.

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[1] Installations for other types of dual motor vehicles are described in the SE325 & SE175 installation manual.

[2] Sometimes called a "BM" contactor.

- an inefficient configuration which can be wired in using SE325 controller, however, we recommend using the D contactor configuration instead.

c) D CONTACTOR

- example: Clark TM series
- uses a "D" contactor to connect the Armature-Field connections together during plugging.

Note: If you wire a parallel motor pair in a series configuration the truck will move slowly if at all. If you wire a series motor pair in a parallel configuration you will get a very large current draw. Excessive currents may damage the motor. Double check which configuration your truck uses before removing old wiring.

B. THE SE325 IN THE "D" CONTACTOR DUAL MOTOR CONFIGURATION

1. It Does

- make sure that at least one set of direction contactors works
- turn a "diode" dual motor configuration into a much more efficient truck
- make all the features of the SE325 available
- solve your D contactor and diode dual motor trucks right out of the box

2. It Does Not

- check that the "D" contactor actually opens and closes
- use both a field weakening and a "D" contactor. The D contactor uses the field weakening contactor driver
- cold switch the contactors when the truck goes in and out of a turn

C. HOW THE "D" CONTACTOR WORKS

1. Plugging

During plugging, the drive motor is turned into a generator. Generated current is "shorted" through the plugging diode so that truck momentum is converted to heat in the armature and the plug diode. During this time, the field current controls the "generator" output (braking torque).

In a dual motor truck both motors generate. In the configuration where the Armature-Field connections for the left and right motors are not connected, slight imbalances between the motors cause one to generate current into the other field causing that motor to lock up.

2. How the "D" Contactor Operates

The "D" contactor forces the voltage at the Armature-Field for the left and right motors to be identical. This prevents one motor from generating into the field of the other motor and therefore avoids lock up during plugging.

The "D" contactor closes whenever the direction changes (when plugging is most likely) or whenever else plugging is detected. Whenever the truck is finished plugging, the contactor opens.

D. GETTING STARTED

1. Determine Which Type of Truck You Have

If you are working on a vehicle that already used a "D" contactor these instructions will tell you how to connect the field weakening output to the contactor block.

If you are working on a truck that used series diodes (sometimes called 6-REC diodes), you will need to install a contactor to serve as the "D" contactor.

If you are working on any other type of dual motor vehicle, refer to the SE325 Installation Manual for instructions.

2. Before You Throw Anything Away

The first step in installing an SRE controller is, of course, removing the old control system. But before you throw out any of the old components, take some time to sift through the parts. You can save money and time by reusing the following items:

- one of the plugging diodes
- steering diodes for the direction contactor coils
- suppression diodes
- the existing "D" contactor (if you have one)

3. Using Existing Direction Contactors

- you can use the existing direction contactors with a SE325, however, the SE325 is limited to a drive current of 2A on the contactor coils. Since the (dual) direction contactors are run in parallel on a dual motor installation it is possible for the current draw to exceed this level. If the current draw does exceed this level then the controller will report a contactor overcurrent and stop. There are three possible solutions 1) reduce the contactor voltage so that the current draw is below 2A (only possible if the current draw only slightly exceeds 2A), 2) replace the contactors with more modern contactors that draw less current or, 3) drive the contactors indirectly using a relay.

4. What Else You Will Need

In addition to the components listed above, you will need the following:

- one SE325
- the accompanying wiring harness
- a PB200 (the PB100 does not have programming support for "D" contactors)
- a "D" contactor (if the vehicle does not already have one)

E. WIRING THE VEHICLE

The following instructions direct you in wiring the vehicle with a "D" contactor. The SE325 uses the **field weakening** output to drive the "D" contactor. Directions for the rest of the wiring are found in the SE325 Installation Manual.

1. Contactor Wiring

Connect the positive side of the "D" contactor coil to the switched side of the key switch. Connect the *yellow* wire to the negative (-) side of the contactor coil.

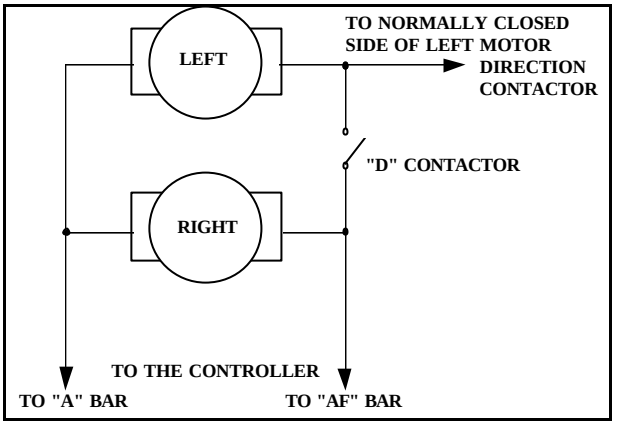

figure 1

The "D" contactor should be wired between the armature-field connections of the left and right motors as shown in **figure 1**. The "D" contactor does not carry a lot of current so #14 wire should be sufficient for this part of the circuit.

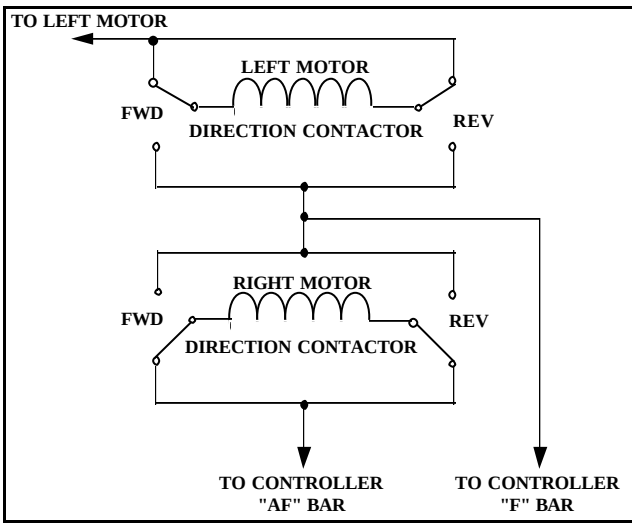

figure 2

2. Direction Contactors

Connect the forward and reverse contactors for the right and left motors as shown in **figure 2**. Please note the normally closed side of both coils. The normally closed sides of the right side contactors are connected to the AF bar, the armature, and one side of the "D" contactor. The normally closed sides of the left side contactors are connected through a plugging diode instead of the AF bar (see **figure 4**).

3. Coil Connections

Figure 3 shows the connections for the

contactor coils. Please note that diodes must be installed to prevent feedback.

You must also install a suppressor on the lift contactor coil.

4. External Plugging Diode

Wire the plugging diode so that its **anode** side is connected to the normally closed side of the left direction block and its **cathode** side is connected to side of the motor that is connected to the **A** bar. See the full wiring diagram at the end of these instructions

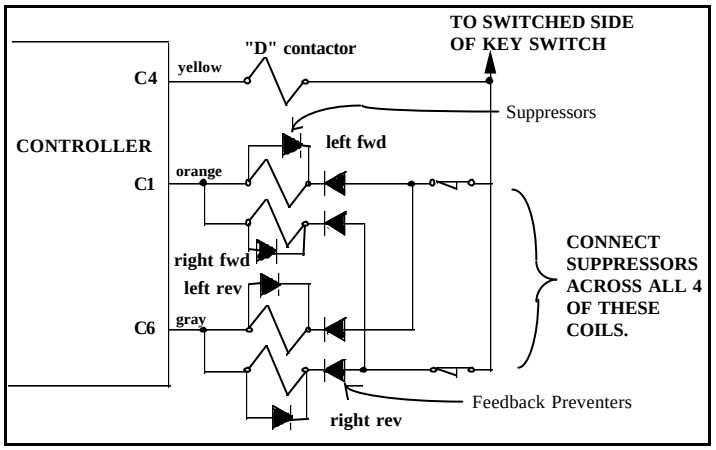

figure 3

5. Light Wiring

The instructions for wiring the key switch, bypass, direction and steering contactor coils, SRO, etc. are found in the SE325 installation manual. **IGNORE ALL DIRECTIONS FOR FIELD WEAKENING** except those given above.

F. PROGRAMMING THE VEHICLE

After you have completed the wiring you must use the PB200 to set the controller to work with a "D" contactor. Go to the "Auto Setup" section of the ProBit and answer the questions as follows:

Is field weakening used?	B: No
Is this a dual motor truck?	A: Yes
Does the truck use a "D" contactor?	A: Yes
Is the "D" ctr wired in place of field weakening ctr?	A: Yes

Next, you will get a message telling you that the "D" contactor is enabled.

G. TROUBLESHOOTING A DUAL MOTOR TRUCK

1. Reminders

You will find three differences with a "D" contactor installation:

- the controller will not check the functioning of the contactor tips of the "D" contactor.
- because the field weakening output drives the "D" contactor, you cannot use both a "D" contactor and field weakening.
- the controller will not cold switch the "D" contactor.

2. Verifying "D" Contactor Operation

To check the "D" contactor, use the PB200 troubleshooting facility (Troubleshoot;Test Truck;Contactors) with a continuity meter to be sure the contactor tips are closing. If the "D" contactor malfunctions, it is not reported with a ProBit fault, but plugging will be severe and uncontrolled.

You can also verify "D" contactor operation by selecting a direction (with SRO satisfied) and watching for the "D" contactor to close. It should close when the direction contactors do. If you then switch back to neutral, the "D" contactor will stay in a short period and then open. If the "D" contactor does not close when expected, it may not have been programmed (See previous section on programming the vehicle). Note: if the throttle is pressed during this test the controller will detect the absence of plugging and drop the "D" contactor out again (I.E. you may see the "D" contactor pull in and the drop out again almost immediately).

3. Overcurrent Faults

Dual motor trucks can be prone to contactor coil overcurrent faults, because they often use two contactors in parallel. If the ProBit is reporting overcurrents (faults #13 and #14A), lower the contactor pull-in voltage and hold voltage about 10%. Continue to lower the voltages until the problem disappears.

The SE325 can only supply 2A to the contactors before it reports overcurrent faults. In some cases it will be necessary to replace the contactors with ones that require less current or drive them indirectly with a relay. Note: if the contactors are driven indirectly with a relay the SE325 will no longer be able to detect coil shorts.

4. Sticky Contactors

Sometimes contactor overcurrent faults create sticky contactor faults (#30, #31). Fix the overcurrent first (as described above), and the sticky contactor faults should disappear.

5. Problems, But No Fault Messages

Both the contactors and motors are in parallel, so as long as *one* of them is working, both of them will pass diagnostics. If you suspect a problem with one set of direction contactors or one of the motors, you can check the circuits independently.

- Turn the steering to full left so that the left turn switch opens. This will remove the parallel path. Then turn on the key switch and check for fault messages.
- Repeat the process for the other turn switch (i.e. with the steering on full right).

If you have any questions regarding dual motor installations or any other technical matters, please call SRE at (800) 461-9338.

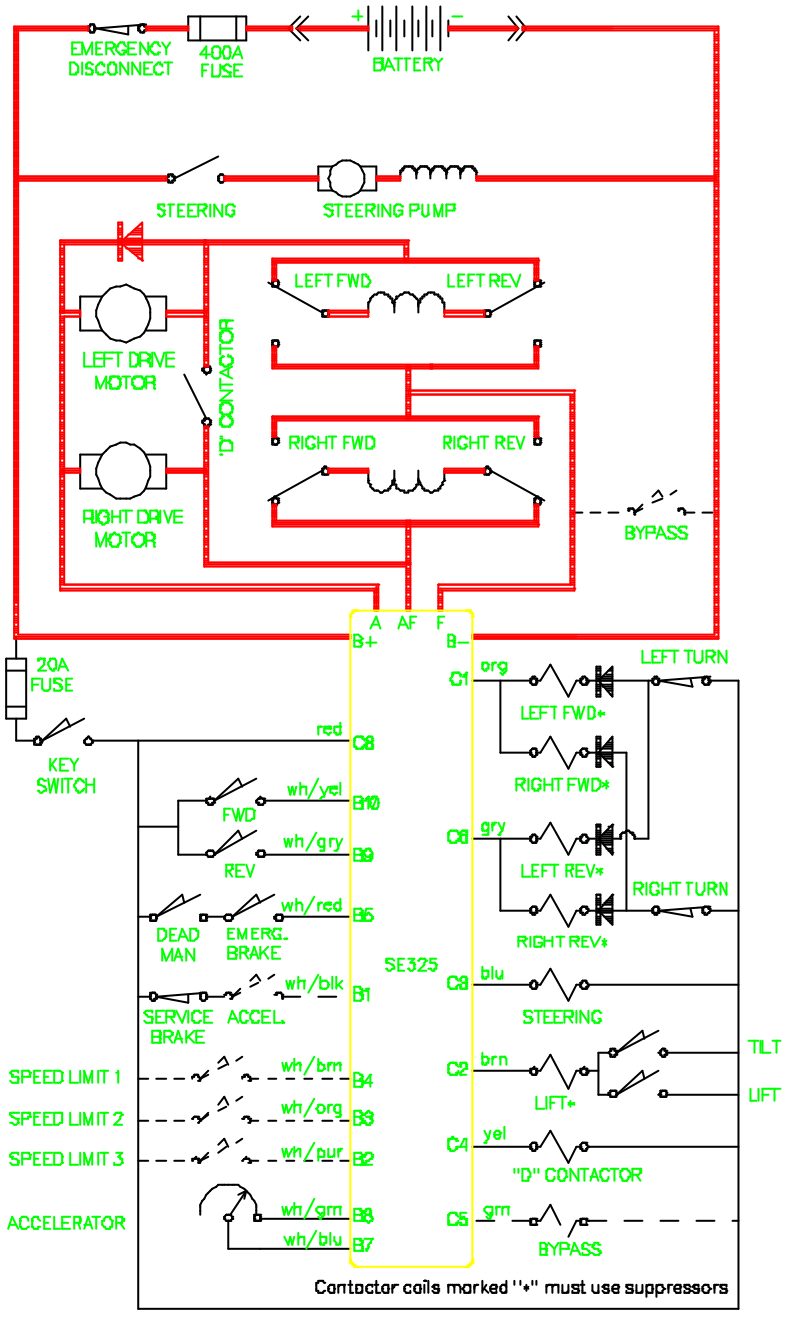
EMERGENCY DISCONNECT
400A FUSE
+
−
BATTERY
STEERING
STEERING PUMP
LEFT FWD
LEFT REV
LEFT DRIVE MOTOR
"D" CONTACTOR
RIGHT FWD
RIGHT REV
RIGHT DRIVE MOTOR
BYPASS
A AF F
B+
B−
20A FUSE
KEY SWITCH
red
C8
FWD
wh/yel
B10
REV
wh/gry
B9
DEAD MAN
EMERG. BRAKE
wh/red
B6
SERVICE BRAKE
ACCEL.
wh/blk
B1
SE325
SPEED LIMIT 1
wh/brn
B4
SPEED LIMIT 2
wh/org
B3
SPEED LIMIT 3
wh/pur
B2
ACCELERATOR
wh/grn
B8
wh/blu
B7
C1
org
LEFT FWD*
RIGHT FWD*
LEFT TURN
C6
gry
LEFT REV*
RIGHT REV*
RIGHT TURN
C3
blu
STEERING
C2
brn
LIFT*
TILT
LIFT
C4
yel
"D" CONTACTOR
C5
grn
BYPASS
Contactor coils marked "*" must use suppressors

figure 4

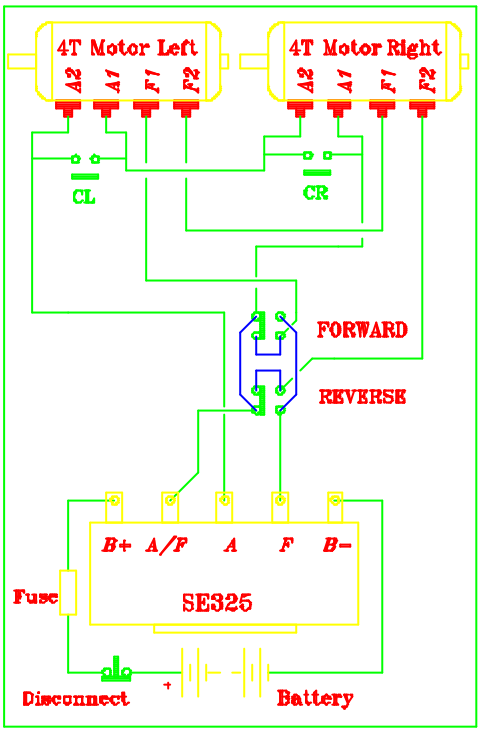

figure 5

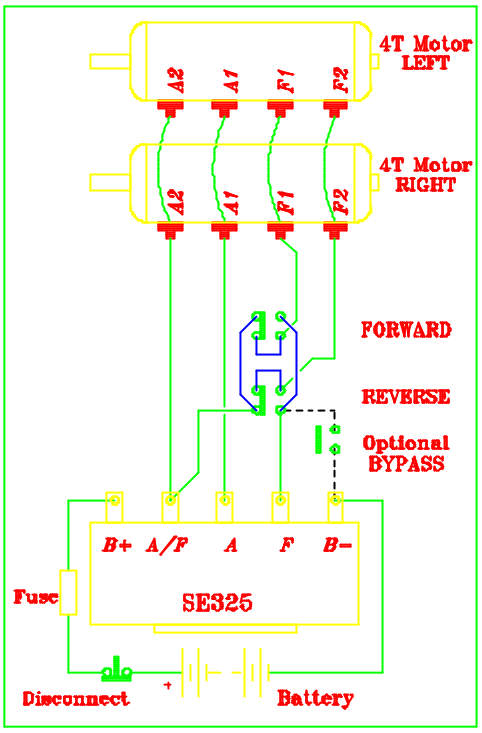

figure 6

Revision History:

93-11-01 JIS -- Original Version.

94-09-20 RTA -- Explain how "D" contactor works. Add contactor coil current draw caution. Better distinguish the types of dual motor installations.

94-12-05 RTA -- Add optional bypass contactor to installation diagram.

95-11-09 RTA -- Modify external plug diode wiring to use controller for return path.