

TENTATIVE INSTRUCTIONS
F & M DIGITAL -5- PROPORTIONAL
RECEIVER AND TRANSMITTER

IMPORTANT : BEFORE RUNNING EQUIPMENT READ ALL INSTRUCTIONS

The Digital-5 proportional system is a complex system and if reliable performance is achieved, the system MUST be treated with the proper care. This equipment is far from delicate but it will not tolerate the usual gimmicks we have used on reed sets in the past. There are precautions in the instructions that may sound down-right silly but these items are the results of thousands of hours of flying and many crashes.

Sets being returned to F & M for service indicate a disregard of these cautions resulting in unnecessary returns for service. F & M therefore finds it necessary to charge for these repairs when our instructions were ignored WITH NO EXCEPTIONS.

The F & M Digital-5 is a five channel all simultaneous and proportional remote control system designed for model use. More than a year has been devoted to engineering and testing the digital-5 to insure a reliable control system providing proportional displacement of control surface. This set uses the latest techniques and incorporates a true digital principle similar to that used in modern Electronic Computers.

Control is accomplished by transmitting a train of short duration pulses coded by varying the distance between pulses. Movement of a control stick changes the position of one pulse to reference to the others. This pulse movement is decoded by the receiver and moves a servo an equal amount. The coded information consists of eight pulses .00025 seconds long separated by a space at neutral of .0015 seconds. The sampling rate is approximately 30 times each second. The transmitter carrier is on the air at least 99% of the time with the modulation using only the 1%. This condition results in very good noise rejection.

The entire system uses silicon transistors with the exception of the servo drive switches which are power Germanium units performance tested and proven in the Bonner Transmite servo. Regulators are used in the transmitter and receiver to insure a minimum of center shift with aging batteries.

TRANSMITTER SPECIFICATIONS:

Case: Aluminum, blue anodized

Size: $6\frac{1}{4}$ X $2\frac{3}{4}$ X 8

Weight: 3 pounds with dry cell installed

Antenna: 60 inch chrome, telescoping. No loading coil.

Power Requirements: 7.2 volt rechargeable installed at factory

Current: Approximately 175 to 200 MA contineous.

RF Power: Approximately 1.4 watts input. .8 watts radiated typical.

Circuit: Etched circuit using Glass epoxy base. MOPA Circuit using 100% modulation.

Temperature: 0° F to 160° F.

RECEIVER SPECIFICATIONS:

Case: Aluminum, Blue anodized

Size: 2 X 1 5/8 X 3

Weight: 5 oz.

Power: Seven 1.2 volt rechargeable cells.

Current: Receiver alone-approximately 30 MA
With 4 servos approximately 65 MA

Sensitivity: Better than 3 microvolts

Selectivity: 30 db down at 10Kc 70 db down at 50 Kc 6 db points 2Kc

Temperature range: 0° F to 160° F

Stability: Zero control shift under all conditions

Circuit: Etched circuit using Glass Epoxy Base.
Superhetrodyne using crystal control.

I.F. 455 Kcs.

THE DIGITAL-5 IS A COMPLEX SYSTEM USING MORE THAN 90 TRANSISTORS AND CANNOT BE SERVICED BY REGULAR MEANS. IT IS MANDATORY THAT IT BE RETURNED TO F & M FOR SERVICE. YOU SHOULD AND UNDER NO CONDITIONS PERMIT A RADIO OR TV REPAIRMAN AND OTHER TECHNICIAN TO SERVICE THIS SET BECAUSE IT REQUIRES SPECIAL SKILL AND EQUIPMENT TO SERVICE IT PROPERLY. DO NOT DISASSEMBLE ANY PARTS OF THIS SET OR SERVOS. KEEP SANDUST AND OTHER FOREIGN MATTER OUT OF THE SERVOS.

RECEIVER:

The receiver can be mounted in any position as it isn't affected by vibration. Mount the receiver in foam rubber or other protective material with at least 1/4 inch separating the receiver from the model. This is only to protect the receiver in the event of a crash and also vibration from damaging any compon such as fatiquing the wires. The receiver has an antenna installed which is approx- imately 40 inches long. DO NOT INSTALL PLUGS OR CHANGE THE ANTENNA LENGTH.

Noise is detrimental to a digital system and a few installations have had difficulty from metal to metal contact of push rods. The worst offender seems to be the engine linkage. It is recommended that non-metallic linkage termina- tions be used or that bonding with flexible wire across these hinge points be used. Don't permit the push wire to rattle or rub against the servo cases, only one case in 50 requires this precaution, but maybe yours is that one. A few extra minutes to take this precaution could save countless difficulties at the flying site. Intermittent run-back of the engine while in flight is usually a good indication of this fault.

UNDER NO CIRCUMSTANCES SHOULD YOU USE SOLID WIRE RUSH RODS. Use wood or other insulating material with wire only at the ends. Solid wire rods can act as a shield for the antenna in certain positions with loss of control. The proportional system must maintain 100% contact to be reliable. This precaution is even more pronounced when flying on the 50 mc band.

TUNING:

Both the receiver and transmitter are tuned and matched at our plant. Under no circumstances attempt to tune or peak up the set. The receiver is tuned to the antenna supplied and will give optimum performance as you receive it, ANY ATTEMPT OR EVIDENCE OF TUNING WILL VOID THE WARRANTY OF THE DIGITAL-5 SET. This also applies to tuning and adjustments of the transmitter.

RECEIVER BATTERIES:

Use only seven rechargeable ni-cads for this application. These batteries should be no smaller than 450 MAH. Commercial packs will be available for this in the near future. If you presently have a five cell reed pack it is only necessary to add two cells in series with the green or negative wire to use it with the digital-5. Be certain that your batteries are in good condition. A cell that you are presently using could be deteriorated to the extent that it would have only 25% of its original capacity. Ni-Cads can be checked simply by using standard glow-plugs. Charge the pack over night to be sure it is capable of delivering its maximum capacity. Touch the glow plug across the battery pack leads using one glow plug for each cell. In other words connect two IDENTICAL glow plugs in series for two cells of the battery pack. The glow plugs should light up and remain lit for 5 seconds. If they don't light up, one of the cells under test is bad. Do not hold the glow plug on the battery longer than is necessary for testing. To determine which cell is bad, repeat the test using one glow plug on each cell individually. Replace the bad cell with a good one. It is recommended that the battery be checked in this manner after every 50 hours of actual use.

RECEIVER WIRING:

The Digital-5 comes completely wired except for the batteries. The connectors are of the highest quality and no attempt to change them should be made. Receivers with the wires changed or other plugs installed will not be covered by warranty. WE DO NOT RECOMMEND USING SWITCHES OF ANY TYPE. Switches are also a source of trouble with even some of the most expensive ones failing. A common practice is to use no switch making the power plug accessible and using it instead of a switch. Solder all connections and check frequently for broken wires. Performance is not guaranteed unless the wiring instructions are adhered to.

PIN CONNECTIONS MEDCO PLUG:

Pin No.1	White	6.0V
No.2	Red	8.4V
No. 3	Black	3.6V
No.6	Green	Neg. Common

TRANSMITTER

The transmitter adjustments have been made at the F & M factory, all that is required to put the transmitter into operation is to charge the batteries. Do not use this transmitter without installing the four screws holding the back cover in place. Movement fo the cover can cause noise which will interfere with operation. Be certain the antenna is tight. It is impossible to adjust this transmitter without special equipment therefore avoid difficulties by not attempting to adjust it.

Neck Strap:

A hole has been provided on the transmitter to permit the use of a neck strap for flying. This hole is the correct size to take a number 4 self tapping screw or screw eye. The screw eye used in most tubes of model cement is s number 4 and can be screw into the can. The recommended neck strap is a saxophone strap that can be purchased at most music stores.

TRANSMITTER BATTERIES:

The Digital-5 transmitter is equipped with a rechargeable battery of 1.2 Ampere-hour type. This battery will operate 6 to 8 hours contineous use on a full charge which should be more than enough for one day of flying. A charger is provided which will charge at approximately 100 MA. The battery cannot be over-charged when using the charger provided 14 to 16 hours charging will fully charge the battery after one day of use. Under no circumstances should any other charger be used. All guarantees will be void if the transmitter is operated on any other battery. The battery test button can be depressed, or the transmitter can be turned on while the battery is being charged without danger to either the battery or transmitter. UNDER NO CIRCUMSTANCES SHOULD ANY EXTRA PUSH BUTTONS OR PLUGS BE INSTALLED IN THE TRANSMITTER CASE, OR WIRING. NO ATTEMPT TO REVERSE DIRECTION OF TRAVEL OR SWAP CONTROL STICKS SHOULD BE MADE. THE DIGITAL-5 IS A COMPLEX SYSTEM AND WILL NOT TOLERATE TAMPERING IF IT IS TO BE RELIABLE. IF USED AS IT IS INTENDED THE DIGITAL-5 SHOULD GIVE MANY HOURS OF TROUBLE FREE SERVICE.

TRANSMITTER ANTENNA:

The antenna used on the transmitter is a base loaded 60 inch whip. The antenna does not use a center loaded coil and does not require it. The output power of this transmitter exceeds that of tube units eliminating the necessity for a center loading coil. The center loaded antenna has a more pronounced null off of the end, which is undesireable for model use.

SERVO:

The servo used with the digital-5 is a Bonner closed loop duramite with amplifiers. The servo torque exceeds four pounds and delivers full torque even for the smallest correction. This eliminates the need for balanced or friction-free control surfaces and linkages. The servo will track and center within one degree. All servos come wired with connectors in place and no attempt should be made to change them, under no circumstances should you cement or glue the components within the Servo or drill holes in the case or cover for linkage mounts. All warrantees are void if a servo evidence of such abuse.

The contacts on the sector arm are adjusted to give the correct pressure and no attempt to change this setting should be made. If a new sector arm is installed adjust it as follows: Install all washers and gears exactly as they were removed. Place the new sector arm on the shaft making sure it and the gears are seated on the shaft. With the cover removed place a straight edge across the servo case directly above the sector contacts. The straight edge should clear the contacts by no more than 1/32 of an inch, but should not touch the contacts. This adjustment will give the best performance as too much pressure only serves to produce more wear on the wiper and potentiometer. The rudder and engine servo are the most susceptible to wear because they remain in one position for an extended time while flying with engine vibration. It isn't likely that a failure will result causing a malfunction with serious results, but instead that particular control servo may not operate smooth and have a tendency jitter or hunt. This would not cause a model to crash and can be corrected by replacing the sector arm with a new one. If it becomes a necessity to clean the potentiometer use a solvent such as carbon-tet that leaves no residue. Lubricate the pot with a minute amount of silicone lubricant. Do not use any other lubricant on any servo wipers or parts.

CAUTION:

When flying in areas that is dusty or sandy, care should be taken to prevent excessive dirt from entering the servos. If even, a minor crash occurs where the wing separates from the fuselage, the servo should have the covers removed with the sectors and pots cleaned and lubricated before running again. Excessive dirt or sand on the servo pots can cause control failure.

The recommended lubricant is Dow Corning 4 compound and can be purchased at most radio supply houses. This lubricant does not melt and heat and therefore will not run or spread.

The direction of servo travel cannot be changed by swapping wires. If the travel is wrong, turn the servo 180 degrees with the wires coming out in the opposite direction.

SERVO COLOR CODE:

Engine- Yellow
 Aileron- White
 Elevator- Orange
 Rudder- Black
 Aux- Green

CAUTION:

When installing the motor servo, be certain that the servo can travel its full limit without hitting a mechanical stop. If the servo hits a stop it will continue to try to drive trying to reach its electrical stop drawing excessive current. Damage to the servo is unlikely, but it will discharge one side of the batteries very rapidly causing system failure.

AUX CHANNEL:

The Digital-5 has the capability of additional channels. The fifth (AUX) channel is wired in the transmitter and receiver you need only plug in the servo to activate it. The Aux lever on the right is wired to give trim on the engine channel. The lever on the left is the 5th channel.

SAFETY FEATURE:

The Digital-5 has a fail safe system built in to give added protection. This system is activated by loss of signal, interference, or incorrect information. When one of the above conditions arise, the system goes into a hold position. In this position the control will remain where you last placed it. The controls will remain in hold for approximately $1\frac{1}{2}$ seconds and if the receiver information still isn't correct it will then run to fail safe. In the fail safe position all controls run to neutral and the engine will run to low speed. The control will remain in fail-safe until the receiver again receives the correct information at which time you again resume control. When installing the control linkage, set the surfaces for straight and level flight with the servos in fail-safe position. To do this turn on the receiver with all servos plugged in. Turn on the transmitter and check to see that they are operating. Now turn off the transmitter. Wait five seconds, turn off the receiver. The servos will be in the fail-safe position which should be the control surface neutral and the engine in the low speed position.

FAIL SAFE FLYING:

In order to adjust the model for fail safe, the following procedure should be followed. The fail safe is of no value unless the model is adjusted properly.

The fail safe centers, receiver turned on transmitter turned off, should be the control position that the model will fly without radio contact.

On the first flight take the model to a safe altitude. Turn off the transmitter and observe how the model flies to fail safe. The engine in low speed will tell you when it is in fail safe. Turn the transmitter on again and land the model. Make adjustments in the linkage to correct the model as observed when flying in fail safe. These corrections must be made in the control linkages and not in the transmitter trim. Repeat the flying and adjusting until the model glides as safe as possible with the transmitter turned off.

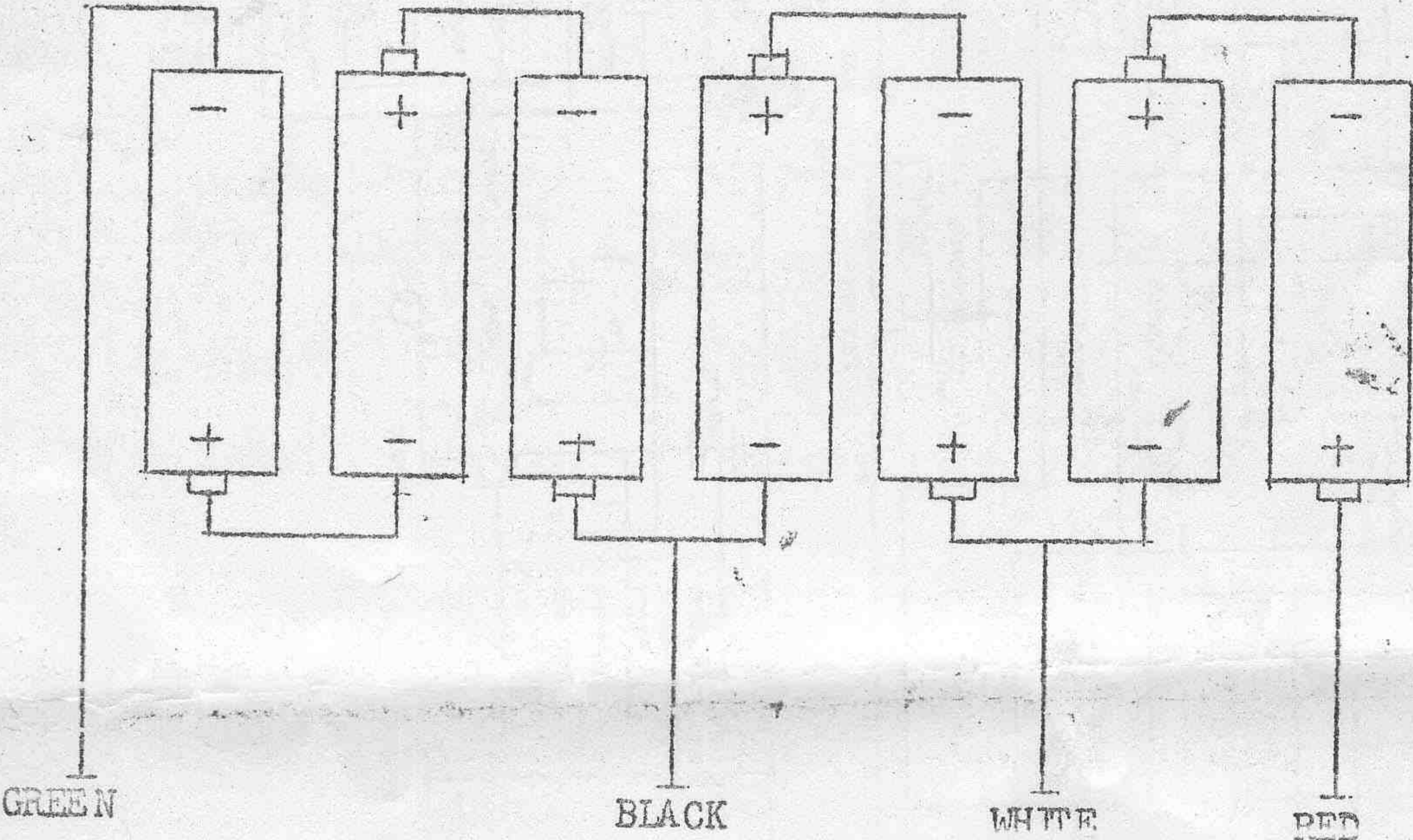
WARRANTY:

The Digital-5 is covered with a 90 day warranty against defective materials or workmanship. Due to the complexity of this set a \$12.00 minimum service charge will be made on sets not covered by warranty. Servo sector arms and gears are not covered by the warranty. Any abuse or tampering of this set including the wiring will void the warranty.

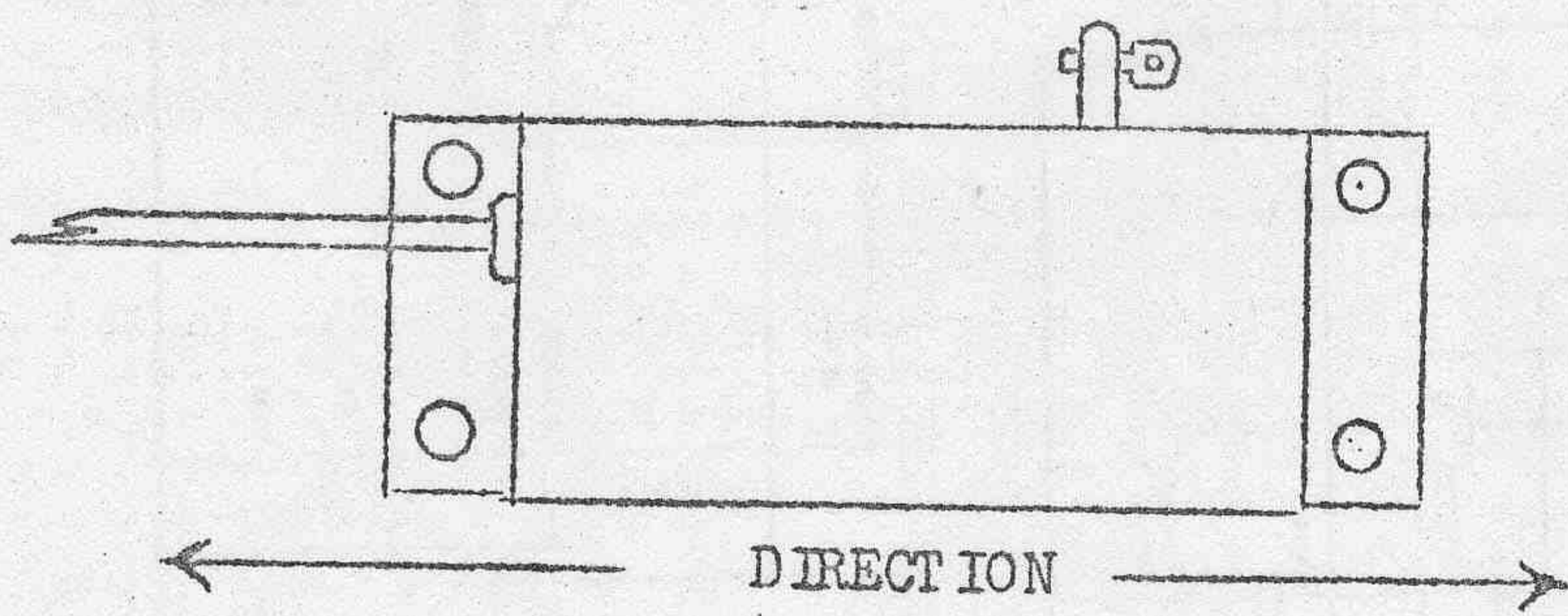
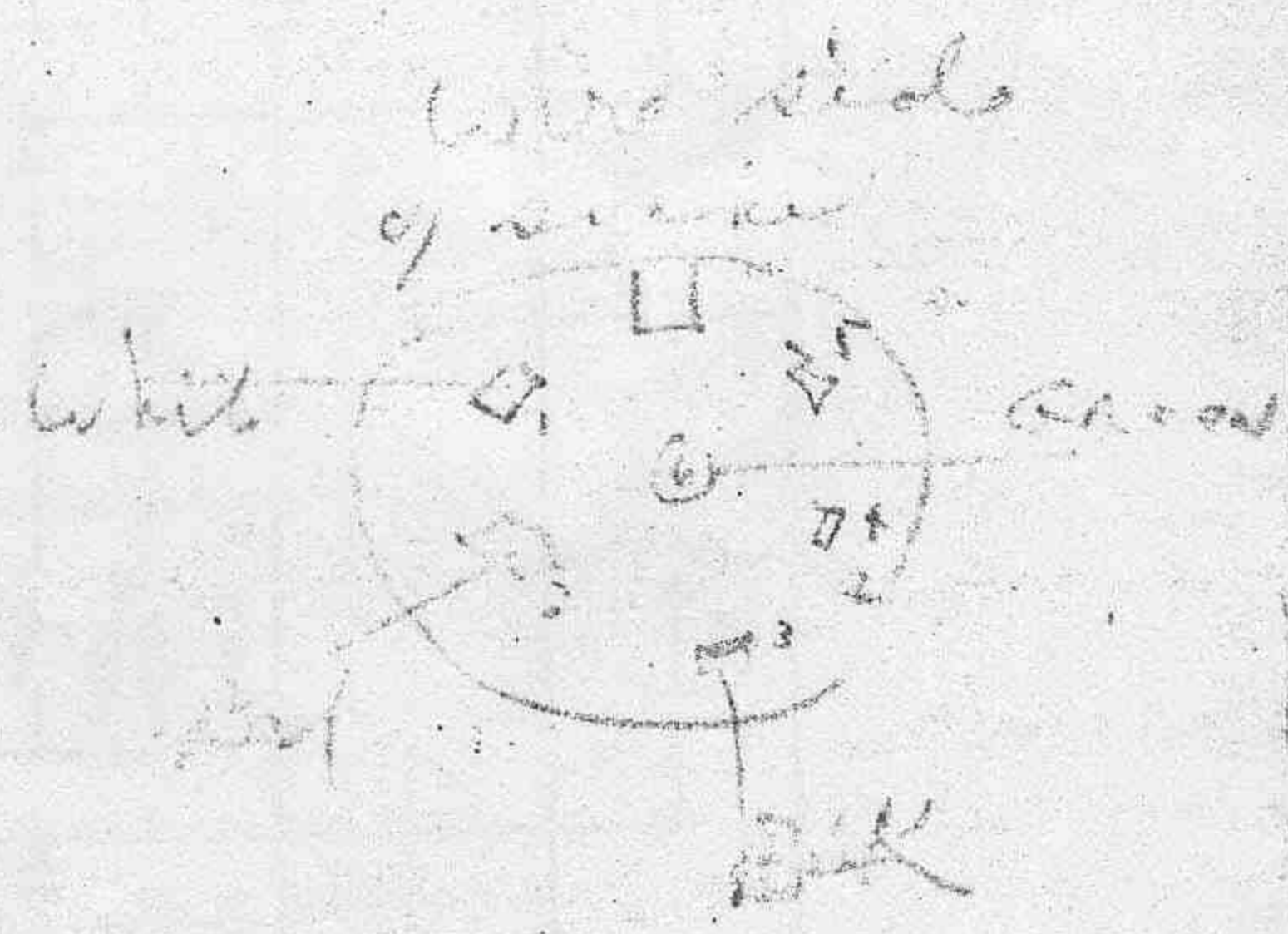
When returning equipment for repair, include the receiver batteries to enable us to determine cause of failure. All repairs are returned COD or CASH in advance.

DIGITAL - 5

RECEIVER BATTERIES
1.2 v RECHARGEABLE CELLS

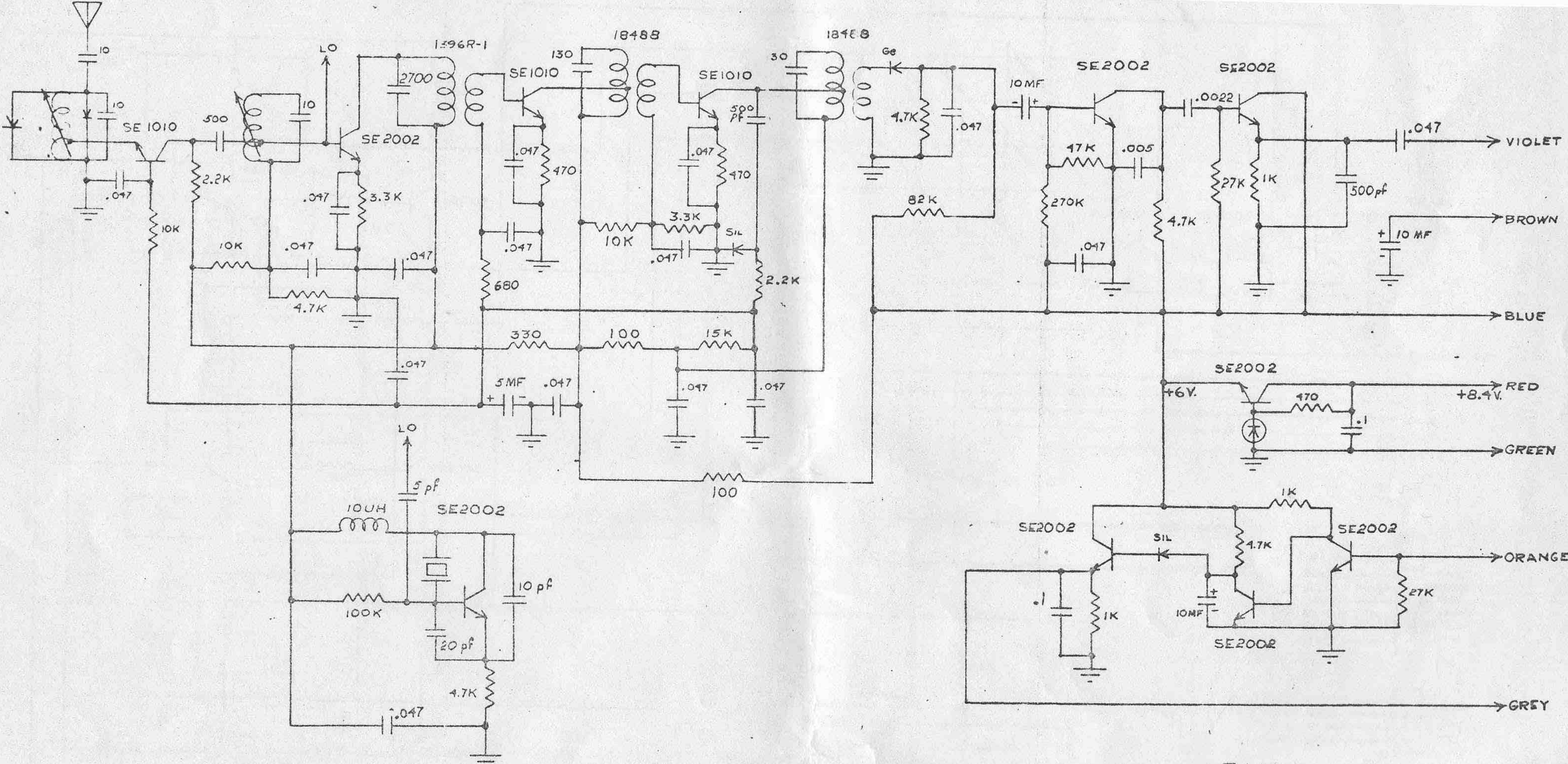


CONNECT SWITCH IN ANY THREE WIRES IF USED.

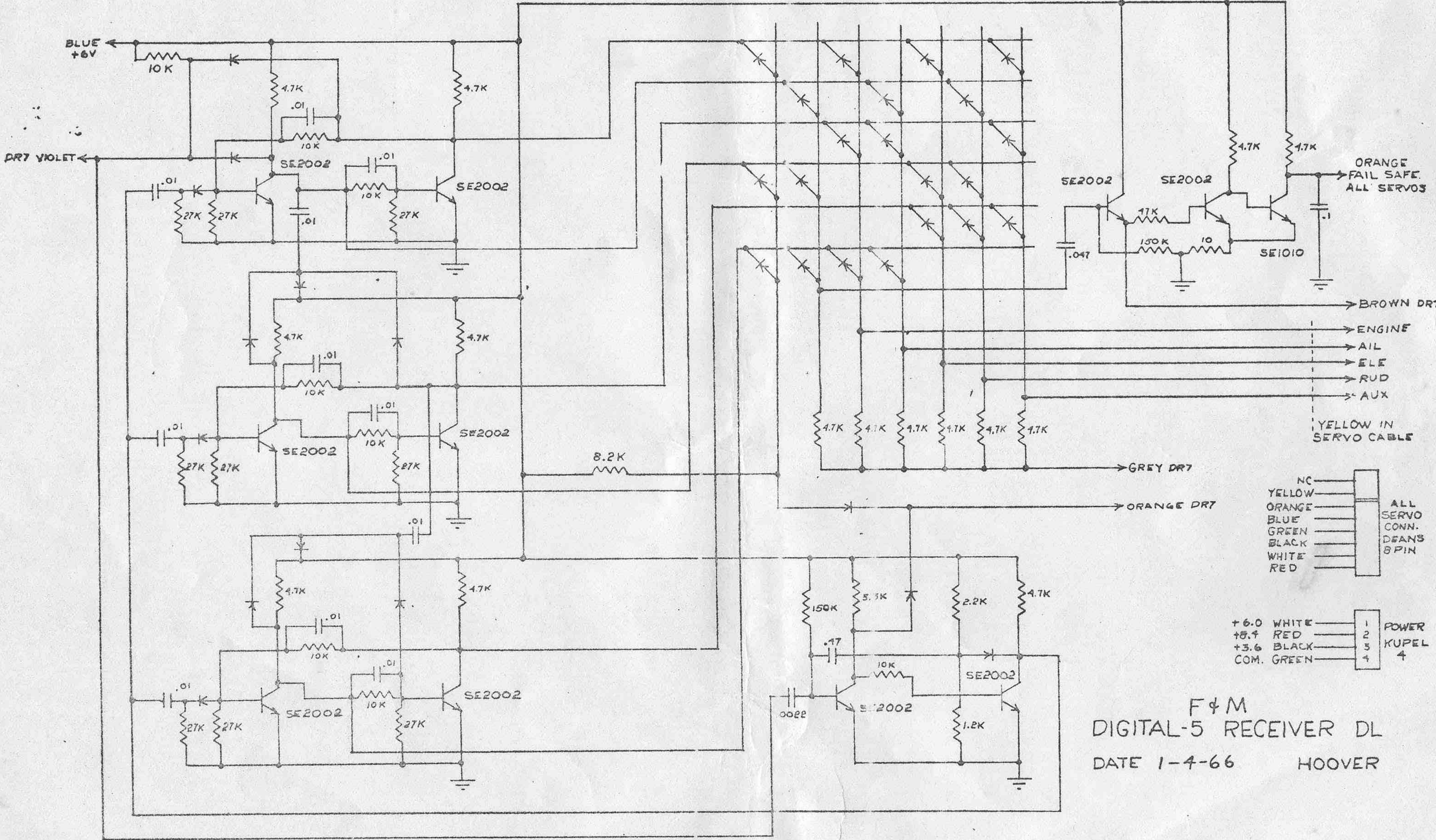


RIGHT	AIL.	LEFT
UP	ELE.	DOWN
LEFT	RUD.	RIGHT
LOW	ENG.	HIGH

MOUNT SERVO POSITION FOR CORRECT CONTROL MOVEMENT.



F4M
 DIGITAL-5 RECEIVER, DR-7
 DATE 1-4-66 HOOVER



F & M
 DIGITAL-5 RECEIVER DL
 DATE 1-4-66 HOOVER

1-2 MS NEGATIVE PULSE
 35 MS BTWN PULSES
 PULSE 6 V RP