MacGregor Industries Limited
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MacGregor Radio Control

DIGIMAC 1+1

DIGITAL PROPORTIONAL EQUIPMENT

INSTRUCTIONS

AN INTRODUCTION TO MacGREGOR RADIO CONTROL

To the discerning modeller our name is already synonymous with precision electronics and impeccable performance. An enviable reputation gained only through years of experience and leadership in the radio control field coupled with continued first-class workmanship and reliability second to none.

You may be confident that when you purchase MacGregor equipment, you are receiving the end product of months of intensive research, development and punishing field trials which will ensure you trouble-free performance for years to come.

All equipment is presented in the distinctive MacGregor style, with brushed, blue aluminium cases and all plastic parts in beautifully moulded, unbreakable black nylon. Metal fittings are all heavily plated to prolong the appearance and prevent undesirable corrosion. Controls and moving parts have all been precision engineered to provide accurate and positive control whilst being sufficiently rugged to withstand the inevitable hard wear to which they will be subjected. The circuits all employ the most up-to-date top quality components and various unique and revolutionary design techniques are incorporated to achieve the ultimate in stability and reliability.

The transmitters and receiver combinations have been designed specifically to provide more than adequate interference-free range for even the keenest-sighted modeller, even in the vicinity of several other R/C operators. — If you do clash frequencies the facility of plug-in crystals allows you to use any one of 12 channels suitably spread over the entire band allotted by the G.P.O.

All these factors, together with the backing of our famous unequalled after sales service, provide the degree of reliability which has become the MacGregor hallmark.

REMEMBER, when you invest in radio control equipment, you want it to work smoothly and reliably for a long time. So do we. Our reputation depends on it! That's why we ask you to read the following instructions carefully and follow any recommendations for installation and use so that faultless operation may be achieved with the minimum of effort.

THE MacGREGOR DIGIMAC 1 + 1 DIGITAL PROPORTIONAL RADIO CONTROL

The Digimac 1 + 1 is a single channel, digital proportional type radio control system with the added facility of an auxiliary sequential control which may be operated simultaneously with the main control without any interaction.

The fully proportional main control provides a high resolution rotary output suitable for controlling directional surfaces on a model such as boat rudder, rudder on 'rudder only' aircraft, car steering, etc.

The auxiliary servo, on the other hand, has a sequential 3-position output (linear) which progresses one position each time the transmitter control button is pressed. This servo is most suited to throttles on combustion engines or, if suitable switching is fitted, for controlling the speed or direction of an electric motor.

The circuits have been designed to work from either dry batteries or from rechargeable nickel/cadmium batteries as desired, without any modification whatsoever. They are fully compensated for reductions and fluctuations in battery voltages due to use and age.

Ni/Cad batteries may be fitted by yourself or, if desired, the transmitter may be returned to us for factory conversion. This service includes incorporation of suitable cells in the transmitter together with a charging socket, and full charging instructions.

A MacGregor AP04 Rechargeable Power Pack is also supplied for the receiver and servos and this merely replaces the AP09 Battery Pack.

A further bonus of this conversion is that the charging socket may also be used for coupling two transmitters together in a Teacher/Pupil arrangement with the AP06 'Buddy Box' Harness.

Charge for Factory Conversion	£8.50 plus postage
AP08 Digimac Charging Harness	£1.00
AP05 Dual Purpose Charger	£3.75
AP06 'Buddy Box' Harness	£1.00

THIS EQUIPMENT IS FULLY PRETUNED AND ALIGNED IN EVERY RESPECT, AND NEEDS NO ADJUSTMENT WHATSOEVER.

DO NOT TAMPER WITH IT AND UNDER NO CIRCUMSTANCES ALLOW ANY PERSONS — QUALIFIED OR UNQUALIFIED — TO ATTEMPT ANY REPAIRS OR ADJUSTMENT TO THE SYSTEM. THIS VOIDS THE GUARANTEE.

NOTE: For convenience in packing, the control stick end knob is removed and packed separately in the carton. This must be fitted by pushing it fully home onto the metal shaft which protrudes through slot in the black escutcheon.

Licences

You need a licence to operate model control equipment. No tests are involved, and the cost is a modest £1.50 for five years. If you do not already possess a licence, application forms are available from: G.P.O. Radio and Broadcasting Department, Waterloo Bridge House, Waterloo Road, London, S.E.1.

BATTERY SUPPLIES

Dry Battery Operation

As supplied, the Digimac 1+1 is provided with special polythene battery boxes for both the transmitter and receiver/servos, and these are designed to take standard high power, 1½ volt, pen cells. Six for the transmitter and four for the receiver and servos.

To gain access to the transmitter battery compartment, turn the back fastener through 90° and lift off the transmitter back. The battery box is inside and should be fitted with six pen cells. WHEN INSERTING CELLS INTO A BATTERY BOX, OBSERVE THE POLARITY CAREFULLY. THIS IS CLEARLY PRINTED IN EACH RECEPTACLE OF THE BOX. ALSO, MAKE SURE CELLS ARE PROPERLY IN PLACE BEFORE REPLACING THE PACK IN THE TRANSMITTER. A piece of tape wrapped round the battery pack will ensure that they will all stay in place. A press stud connector is provided for connection to the transmitter pack, and this should be pressed firmly into place before insertion of the pack in the transmitter case. This connector also ensures correct polarization of the supply. Replace the transmitter back after insertion of battery pack and crystal (see later paragraph) by lining up the stud slot with the top of the case and pressing firmly home.

The receiver/servo power pack is dealt with in the same manner as the transmitter pack, but in this case only four pen cells are required and connection to the receiver is made via a four-pin polarized socket which mates with the four-pin plug on the receiver.

Battery Replacement

The battery packs supplied, provided high power type pen cells are used, will give continuous operation for up to 4 hours. Where possible, however, a voltmeter should be used to test both power packs on load. THE BATTERIES SHOULD BE CHANGED WHEN THEY REACH 7.5 VOLTS AND 4.8 VOLTS FOR THE TRANSMITTER AND RECEIVER RESPECTIVELY. The set should continue to work below these battery voltages but erratic servo action and serious reduction in range will be experienced and operation under these conditions should not be attempted.

Never replace single cells at a time, as this, although not detrimental to the circuits, will considerably reduce the life of the new cells.

Rechargeable Ni/Cad Operation

Should it be desired, rechargeable nickel/cadmium batteries may be used for both transmitter and receiver instead of dry batteries. Voltages required for Ni/Cads are 9.6 volts for the transmitter and 4.8 volts for the Receiver and servos. A minimum capacity of 280mAh is recommended for both batteries but 225mAh may be used for the receiver if one accepts a slightly shorter 'life'. Scintered cell types should always be used where possible.

The MacGregor AP04 Rechargeable Power Pack is recommended for use with the receiver and servos and this is complete with integral switch and moulded battery and switch boxes to protect the units from dirt and damage. Factory conversion of the transmitter can be carried out at moderate cost and details of this are given on Page 1.

CRYSTALS

The Transmitter and Superhet Receiver are provided with a crystal socket to enable the user to use any frequency desired, simply by insertion of the appropriate crystals.

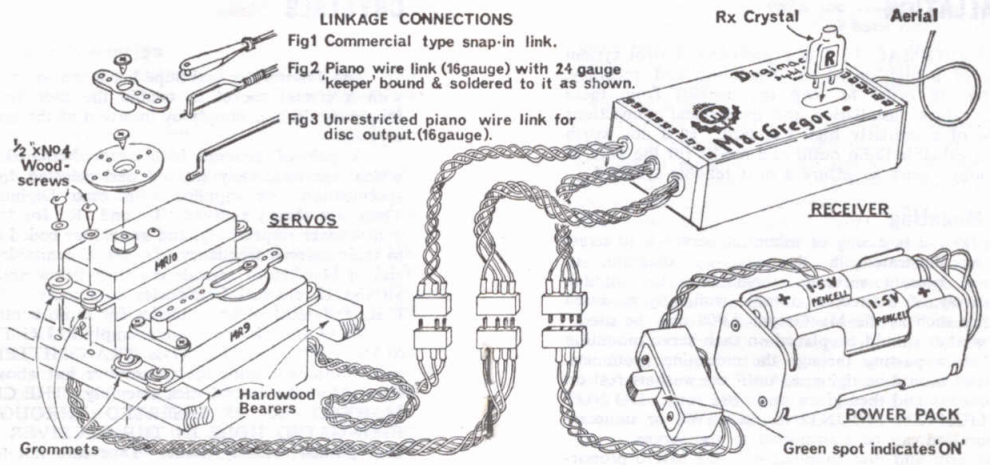
A pair of genuine MacGregor Matched Crystals, which are accurately ground and selected to a rigid specification, are supplied with each Digimac outfit. These are clearly marked 'T' and 'R' for transmitter and receiver respectively, and are colour coded according to their channel frequency. (A list of available frequencies in MacGregor crystals is shown below and includes all the 12 channel frequencies commonly used in the U.K. and most other countries for radio control.)

To fit crystals in the units simply PLUG THE ONE MARKED 'T' INTO THE TRANSMITTER crystal socket situated inside the transmitter just above and to the right of the control stick assembly. THE CRYSTAL MARKED 'R' IS INSERTED THROUGH THE ELONGATED HOLE IN THE RECEIVER case and then pushed securely home. Take care not to reverse these.

NOTE: Use of crystals not correctly matched will seriously affect the performance due to the high degree of selectivity of the receiver. Therefore ALWAYS USE MacGREGOR MATCHED CRYSTALS AND TAKE GREAT CARE NOT TO DROP OR HEAT THEM AS THEY ARE DELICATE COMPONENTS AND CAN EASILY BE DAMAGED BY IMPACT OR HEAT.

Channel	Colour	Tx. Frequency (MHz)	Rx. Frequency (MHz)	Part No.
1	Brown/Grey	26.970	26.500	MRO
2	Brown	26.995	26.525	MR1
3	Red/Brown	27.020	26.550	MR1/2
4	Red	27.045	26.575	MR2
5	Orange/Red	27.070	26.600	MR2/3
6	Orange	27.095	26.625	MR3
7	Yellow/Orange	27.120	26.650	MR3/4
8	Yellow	27.145	26.675	MR4
9	Green/Yellow	27.170	26.700	MR4/5
10	Green	27.195	26.725	MR5
11	Blue/Green	27.220	26.750	MR5/6
12	Blue	27.255	26.785	MR6
13	White	27.270	26.800	Not available

When you are satisfied that all is as prescribed and the batteries and crystals are installed as instructed, the Digimac is now ready to operate as follows:



SPECIFICATIONS

TRANSMITTER
Size: 151mm. x 89mm. x 38mm. (6" x 3.5" x 1.5").
Weight: 12.75 ounces with dry cells.
Aerial: Bottom loaded. 1.26m. (48") fully extended. 61mm. (2.4") retracted.
Supply: 9-10 volts Dry Cells or Ni/Cads.

RECEIVER
Size: 70mm. x 38mm. x 22mm. (2.75" x 1.5" x 0.875").
Weight: 2.25 ounces (64 gms.)
Supply: 6 volt Dry Cells or 4.8 volts Ni/Cad.
I.F. Frequ.: 470 KHz.

SERVOS
Size: 48mm. x 36mm. x 21.5mm. (1.875" x 1.4" x 0.85").
Output arms extend 6.5mm. (0.25") above case. Lugs extend 8mm. (0.3") each side.
Weight: MR10—1.8 ounces (51 gms.).
MR9 —1.7 ounces (48.2 gms.).
Output: MR10—Rotary up to 5 lbs. (2.3 Kgm.) over 90 deg. transit.
MR9 —Linear 3 position. Pull 5 lbs. (2.3 Kgm.).
MR10 Transit Time—1.0 sec. for full travel.
Supply: 2.4 + 2.4 volts.

BATTERY PACK (AP09)
Size: 60mm. x 30mm. x 30mm. (2.375" x 1.16" x 1.16").
Weight: 2.8 ounces (79.5 gms.) with switch, harness and 4 x 1½ volt pen cells.

ALL UP WEIGHT
Including Rx, AP09 Battery Pack and 2 servos – 8.55 ounces (243 gms.).

OPERATION

1. With reference to the hook-up diagram above, connect up the receiver to the Power Pack and Servos, with the ON/OFF switch in the ' OFF ' position (Green spot indicates ON). Extend the receiver aerial.
   PLEASE NOTE: ALL MacGREGOR PLUGS AND SOCKETS ARE POLARIZED TO SAFE GUARD AGAINST INCORRECT CONNECTION. (One pin is spaced farther apart from the rest.) MAKE SURE YOU DO NOT FORCE THE PINS IN THE WRONG WAY.
2. Switch on Transmitter. The ON/OFF switch is situated on the left of the transmitter and its function is clearly indicated.
   FOR TESTING AND CHECKING THE SYSTEM THE TRANSMITTER AERIAL MAY BE RETRACTED, BUT AT ALL OTHER TIMES WHEN THE EQUIPMENT IS IN OPERATION, THE AERIAL SHOULD BE FULLY EXTENDED.
3. Switch on the Receiver. If not already in its centre position the proportional MR10 servo should immediately centre and stop. Apart from a possible twitch of the auxiliary MR9 servo on initial switch-on, no other movement should take place.
4. Move the transmitter control stick from side to side. The MR10 servo will move in accordance with the stick movement and should stop when the stick is held in any position. The position of this main servo is ' proportionally ' dependent on the position of the stick at all times.
   When released, the stick control will automatically return to neutral and the MR10 will centre accordingly.
5. To operate the auxiliary servo, press the small control button situated immediately below the control stick. The MR9 auxiliary servo will move and take up a new position where it will stop. The servo has three positions in all and moves progressively one position at a time, irrespective of how long the button is pressed, *i.e.*, in order to move two positions the button must be pressed twice and so on.
6. Finally, switch off the Receiver, then switch off the Transmitter, in that order. This ensures that the servos remain in the same positions and ready for installation. Similarly always switch the Transmitter ON first, then the Receiver.
   ALWAYS CHECK THE SYSTEM FOR CORRECT OPERATION AND RANGE BEFORE RELEASING YOUR MODEL. Initially the Maximum range with the Transmitter Aerial fully extended should be verified, and also the range with the aerial fully retracted should be assessed and noted. This latter measurement is sufficient to verify the absolute range of the equipment and should be checked before each day's operation and also after any crash or particularly heavy landing.

INSTALLATION

The DIGIMAC 1+1 is a precision control system capable of a high degree of resolution and accuracy. Therefore, in order to reap the benefits from these intrinsic values, installation and mechanical connections must be of a similarly high standard. It is not worth risking a valuable radio outfit and model for the sake of a few hours' work to ensure a neat reliable system !

Servo Mounting

By far the best way of mounting servos is to screw them, as illustrated in the hook-up diagram, to hardwood bearers securely glued into the model. Alternatively, if desired, a suitable resiliently mounted servo tray such as the MacGregor AP08 may be used.

A washer should be placed on each servo mounting screw before passing through the mounting grommets. The screws should be tightened until the washers rest on the grommets and then given one extra turn. DO NOT OVERTIGHTEN MOUNTING SCREWS or unnecessary vibration can be transmitted to the servos.

The arm and disc supplied with the MR10 proportional servo will fit in any of four positions and can be altered or interchanged simply by removal of the retaining screw in the centre. Don't forget to replace this screw securely after any change.

Linkages

Before connecting to servos, linkage arrangements must move freely yet without backlash, with the model in any position. Hinges and other bearing joints should be as frictionless as possible, otherwise drag will be imposed on the servos, resulting in unnecessary load on the power pack and hence a cut in useful operating time.

The best linkages are the push rod types with commercially available adjustable, clip-in connectors (see Centre Page Diagram Fig. 1), or connectors made from bent piano wire fitted with keepers (Fig. 2). Where these types of connectors are used it is recommended that, for the MR10 servo, the output arm be used as opposed to the disc as the latter will restrict the movement of the linkage and can jam up. If the disc output is preferred, a piano wire connector shaped as in Fig. 3 should be used.

Always ensure the servos are not 'stalled' in any position, due to mechanical stops in controls, etc. (*e.g.*, throttle) as this will drain the batteries and can cause damage to the servo itself. Where such mechanical stops are present, the control arm should be arranged so that full control coincides with full servo travel.

The amount of push rod movement can be adjusted roughly by choice of holes on the output devices, but some adjustment should be allowed for in the linkage for final trimming up.

Always ensure the MR10 is neutralized and the MR9 is in the correct position as required, before adjusting linkages.

Receiver and Power Pack

These should both be loosely wrapped in ¼"–½" foam rubber, or similar material held in position by a rubber band. They can be mounted in any suitable position, but should be packed in the model so that they cannot move about. The power pack should be

sufficiently separated from the receiver and servos so that, in the event of a crash or hard landing, it will not cause serious damage to these units. In the case of an aircraft the power pack can be conveniently used to adjust the C. of G. by suitable positioning, *e.g.*, as nose weight in a glider.

The full receiver aerial (33" long), where possible, should be knotted and led out to the tail fin or similar attachment point so that no strain is put onto its connection in the receiver. Use an elastic band at its remote end to tension it. In the event of a crash this will break first, rather than the aerial itself!

Avoid shortening the aerial as this will result in considerable loss of range. For model boats or land vehicles, where usually not so much range is required, the aerial may be cut to, say, 18" and then securely soldered to a vertical whip aerial 15" long securely mounted on the superstructure or hull. This maintains the overall length of the receiver to the correct 33". The whip aerial can be made out of small bore brass tubing with a bead at the end to safeguard against accidental damage to the eyes, and should be well insulated from any metal parts.

Switch

This can be mounted on the servo mounting panel as previously described if desired, or otherwise in any convenient position in the side or top of the model. To fit the switch, remove the two retaining screws from the special moulded encapsulation, fit the switch dolly into a suitable cutout to ALLOW FOR ITS UNIMPAIRED OPERATION, and screw the switch in place with suitable screws (8 BA or No. 2 Self Tappers) through the surface to which it is being mounted. CHECK FOR THE CORRECT OPERATION OF THE SWITCH AFTER INSTALLATION.

General

Avoid trailing leads where possible and make sure nothing can move (apart from the control linkages, of course !).

The equipment has been designed from the outset to be insensitive to interference and 'metal to metal' noise. However, as a general rule it is recommended, for absolute safety, that all joints and couplings, where two metal parts can rub together (*e.g.*, linkages on control horns, prop, shaft couplings in boats, etc.), be eliminated and only plastic to metal couplings be used. Where this cannot be avoided the two metal parts should be linked by a short flexible piece of wire.

Always ensure that your installation is fuel proof and water proof, particularly in connection with marine models. Water, and in particular salt water, is the major enemy of electronic equipment, causing varied effect from slight wandering off tune to complete breakdown due to corrosion of p.c. boards and components.

In aircraft and cars, the receiver and power pack can be protected by placing them in plastic bags. For boats the use of a polythene 'sandwich box' is recommended and this can contain the complete installation. Push rods and wires can be brought out via suitably greased tubing secured through the box.

Where installations are completely enclosed with no vents, a small sachet of Silica-Gel crystals should be enclosed to absorb any condensation which may form, and this should be changed periodically.

A FINAL RECAP

The following is a list of GOLDEN RULES for the successful operation of your DIGIMAC controlled model.

1. Range check your equipment with the Tx aerial fully extended before the first operation in a model, and verify this periodically in the same spot.
2. Then, carry out a few short range checks with the aerial retracted, to use as your standard, quick check before each day's operation.
3. Always ensure your transmitter aerial is fully extended before releasing the model.
4. Always ensure that you are not interfering with another modeller who is on your frequency. If so, change frequency or switch off and wait !
5. The output of the transmitter is a minimum along the axis of its aerial. Therefore, avoid pointing the aerial at the model.
6. If there are several modellers around, you should always form a group (20-30 yards apart will do) and never let your model pass very close to another transmitter.
7. If you are new to proportional model control, it is advisable to enlist the help of an experienced radio control modeller, particularly in model aircraft flying when initially testing and learning to fly. Our 'Buddy Box' facility will considerably help you through this period.
8. 'Novice' model aircraft pilots should always use small control surfaces and small movements. Over-control is the cause of the majority of aircraft crashes.
9. Always check your installation for any damage or displacement before each day's operation and also after any crash or particularly heavy landing. Particularly check :—
   (a) That all functions operate normally over their full range of travel even when the engine is running.
   (b) All servos for any damage or wear due to vibration, particularly the mounting flanges, output arms and retaining screws.
   (c) That batteries are connected correctly and securely and that battery voltages are normal. (Carry a spare set of pen cells just in case !) If converted to rechargeable Ni/Cad operation, ensure batteries are fully charged.
   (d) All plugs and sockets for good fit. Good contact can often be restored by bending the pins slightly to increase contact pressure.
   (e) Periodically check all cables for signs of strain. Slight flexing or tugging of cables may disclose an intermittent fault before it has time to do any damage.
10. ALWAYS investigate any apparent failure, however brief. Faults can be very intermittant and difficult to find but IF IN DOUBT — DON'T RISK IT ! YOU MAY DO IRREPARABLE DAMAGE WHICH COULD HAVE BEEN AVOIDED.

GUARANTEE AND REPAIR SERVICE

MacGregor Radio Control Equipment is guaranteed against faulty manufacture for a period of six months from date of purchase.

A Guarantee Card is included with your outfit, and this must be completed and returned to us within fourteen days, after verifying the correct operation of your equipment.

The Guarantee covers faulty equipment caused by defective components or manufacturing error only, and provided the equipment has not been tampered with, we will repair and service it free of charge.

Damage incurred from crashing of models or mishandling of the equipment is not covered by the Guarantee and a service charge will be made accordingly for any repairs carried out.

REMEMBER : In 90% of crashes due to equipment failure there was a prior warning. Very few faults occur due to component failure, even less are due to manufacturing defects. Nearly all failures are due to damage resulting from previous crashes and mishandling, so always investigate BEFORE operating and avoid these unhappy occurrences.

To ensure prompt service when returning equipment, please follow the instructions listed below, carefully.

1. Remove all batteries from power packs as these can corrode and cause damage, as well as greatly increasing postal costs.
2. If rechargeable batteries are fitted, please charge for at least 14 hours prior to despatch.
3. If you are sure of the failure, return only the items which need attention. If any uncertainty exists at all, however, the complete outfit should be returned. A minimum handling charge of 50p is made for each item returned where repair is not covered by our Guarantee.
4. Remove servos from mounts and any padding from receiver.
5. Different plugs or other modifications which interfere with factory testing procedures will be returned to original standards at your expense.
6. Include a brief, but thorough, explanation of all problems and service required.

Our Guarantee does not cover loss or damage of equipment whilst in transit. Therefore :—

7. Carefully pack each individual item with sufficient packing material to prevent shipping damage. Include a list of all items being returned and double check that all items listed have been packed !
8. Include your NAME AND FULL ADDRESS inside the parcel as well as outside. Also, for your own protection, register or insure all parcels.
9. Label your parcel clearly in at least two places and send to :—

MacGregor Industries Limited (Radio Control Division)
Canal Estate, Langley, Bucks. SL3 6LQ.

In the event of repair under Guarantee your equipment will be returned to you post free. In all other cases an estimate will be sent to you covering the cost of repairs and postage and no action will be taken until approved by you and payment made.

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