mc-16/2

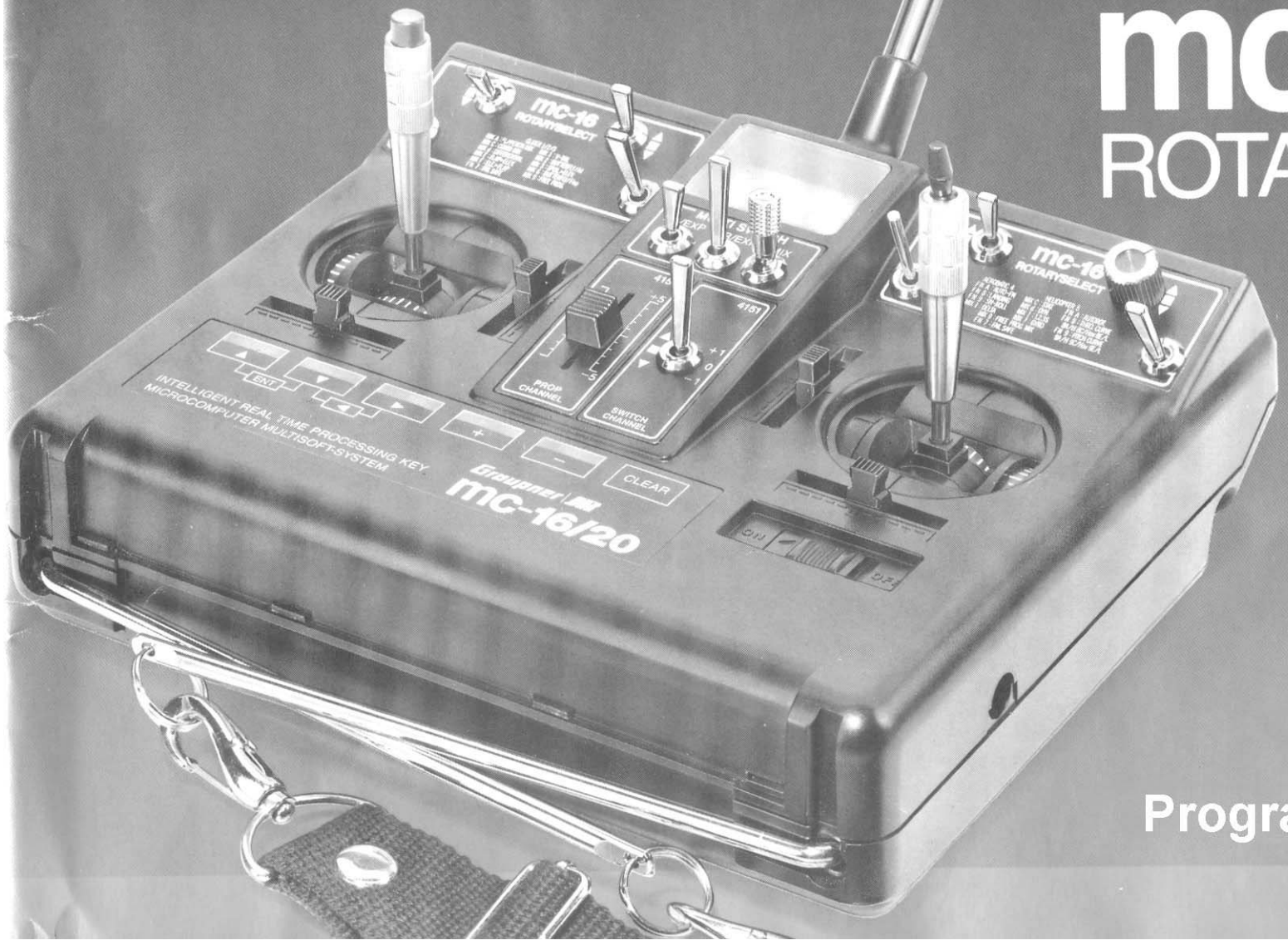
Graupner | JR

REMOTE CONTROL

COMPUTER SYSTEM

mc-16/20

ROTARYSELECT



Programming Handbook

Contents

mc-16/20

Expandable Radio Control Set for a maximum of 16 channels

Using the proven computer system mc-16 as the basis of the new mc-16/20 Microcomputer Remote Control set was developed. With the series already equipped with 20 model memories, the mc-16/20 offers features to beginners and more experienced equally.

The controls and ergonomically optimised transmitter case have been developed further and gain an LCD for precise and clear display of all functions. It also enables, even in bright sunlight, secure adjusting and reading of all model-specific parameters.

A more intelligent chip and complex software offer a maximum of security and reliability. Owing to this innovative technology, modules for the implementation of complex coupled functions are no longer required in the transmitter, and complex mechanical mixers become unnecessary in the model construction.

The program selection, based on experience, are simpler and offer the scope and flexibility to adjust complex control functions to suit the requirements of the user. In particular, importance was attached to the interests of the intermediate user.

The user is persuaded by the simple and clear menu structure, and the conveniently fast selection of most functions. In addition, the mc-16/20 copes with every request up to the demanding competition application.

Half the program functions are common to the five different model types. Each type of model, from the simple glider to the modern high speed helicopter, contains model type specific functions, which allow programming of a flight model. Depending upon personal requirement and operator ability, individual functions can be switched off with optional external switches.

You should take notice of the organisation of the completely revised programming manual, and in particular to the clear and detailed operation and programming structure it represents.

Since the software covers special programs for the operation of both fixed-wing models and modern model helicopters, the operating instruction are arranged into several sections:

After a section concerning general operating instructions, the second section gives transmitter basic adjustments. Thus adjustments independent of model type, are described like model storage, name, type and modulation mode, among other things.

Following this are adjustments such as servo direction, servo reversal, freely programmable Mixers, etc., since these functions are common to all model types at your disposal. Afterwards the program descriptions for model types of the class of gliders and power planes follows.

STANDARD,
UNIFLY,
F3B / BUTTERFLY and
AEROBATIC.

The fifth model type is dedicated to the helicopter. It covers all adjustment possibilities that available for the programming of a helicopter, even if they were already described for the fixed-wing models. This saves time consuming paging back and forward the instructions. Due to the complexity of the programs with this type of model it is recommended to observe the suggested programming order.

The reference sections are placed in front of the program sections for each type of model, and functions in clear flow charts and menu diagrams. Block diagrams clarify, in a simple way, the signal flow through the different functions that can be modified and between the control sticks and receiver outputs.

In the appendices the NAUTIC multi-function module is presented. It also contains information about further accessories, technical data etc.

Is advised that the beginner and less experienced model fliers initially attach as many servos as possible to the receiver and to first complete all functions in accordance with the guidance. He will learn, in the shortest possible time, the main operating steps of the mc-16/20 required to be able to make a meaningful program for the model to be finished.

Kirchheim Teck, in June 1993.

COMPUTER-SYSTEM mc-16/20
With ROTARY SELECT Programming

High security using modern single chip computer technology. Newly developed LCD multi-data display with integrated static driver for precise, clear digital display. The extremely high contrast enables, even with bright sunlight, a precise check of the functions displayed in the transmitter display such as operating voltage, input data, mixer functions, settings, direction of rotation, trim and programming information with multi-function programs.

- The transmitter has a 20 model memory with integrated backup Lithium battery (life span approx. 5 years).
- New, improved 6 key input terminal for program selection and adjustments (ROLL UP, ROLL DOWN, CH SEL, INC, DEC and CLEAR).
- Large, clear LCD multi-data display for adjustment of programs as well as input and viewing of data.
- Adjustable precision, height and spring centring force control sticks with electronic trim.
- High speed CPU with 10 bit A/D converter.
- Programming simplified by versatile and simple multi-function menus in combination with the new Rotary Select technology.
- New Real Time Processing system (RTP), programming with direct reading.
- Programmable Dual rate for three servo functions and adjustable between 0 and 125%.
- Exponential control characteristic switchable between two values for three servo functions.

- Sub Trim system for the neutral adjustment of all Servos and adjustment of older makes of servos with inconvenient neutral.
- Servo Throw (adjustment of full servo travel) adjustable between 0 and 160%. Allows setting symmetrically or asymmetrically to allow the servo to move more less in one direction
- Reverse function for all Servos.
- Differential mixer for ailerons.
- Selector for the easy switching of the control mode 1... 4 (throttle on the right left).
- Switchable modulation system PPM or PCM. PCM operation is only possible with the receivers mc-12, mc-18, mc-20 and DS 20-mc.
- High security by precise digital display of the operational data.
- Integrated computer alarm system.
- Stopwatch and alarm timer, linked to throttle stick.
- expandable with the Multi-Prop and NAUTIC-Expert modules.
- Can use all proportional & switch modules as well as external switches of FM 6014/4014 systems.
- Minimum switch computer concept. The system automatically switches functions, for safety reasons, if the beginner model constructor does without the switch.
- Five simple, yet complex, fixed-wing multifunction core programs, for F3A, F3B, F3C, F3D and F3E (completely programmed multi-mixer units, which can be stopped by using additional mixers accordingly).
- Mixer for V-tail and delta models.
- Super helicopter program for normal swashplate, HEIM, 120° systems or those with four linkages.
- Three freely programmable mixers.

mc-16/20

16 Channel Microcomputer Radio Control system

Sets
Part No. 4838* for the 35 MHz band
Part No. 4845* for the 40 MHz band
* In each case the transmitter battery, 9.6v / 1.4 Âh (Part No. 3407) needs to be added separately.

The sets contain
8 Channel Microcomputer ROTARYSOFT mc-16/20 Transmitter, expandable to 16 channels.
HF Transmitter module of the appropriate frequency.
16 channel MINI-SUPERHET C 16 S of the appropriate frequency.
Servo C 507
Switch harness
Pair of quartz crystals from the appropriate frequency band.

Power supply for transmitters and receivers
Removable 9.6v batteries for transmitters
Part No.
3407 Varta RSE 9.6v / 1700mAh
3208 Sanyo KR 9.6v / 1300mAh
3210 Graupner 9.6v / 700mAh
3408 Varta RS 9.6v / 500mAh
Removable 4.8v batteries for receivers
Part No.
3465 Varta RSH 4.8v / 2000mAh
3448 Varta RSE 4.8v / 1700mAh
3464 Sanyo KR 4.8v / 1400mAh
3444 Varta RS 4.8v / 600mAh
3446 Varta RS 4.8v / 600mAh
3463 Sanyo AA 4.8v / 300mAh[1)]
[1)]For special applications (short time use)

Further 4.8v batteries see Graupner main catalogue.

For fitting into the battery carrier
(designed for recipient 4 batteries)
Part No.
3659 Varta RS 1.2v / 500mAh
3617 Graupner RS 1.2v / 500mAh

Accessory for transmitters (see pages 94 – 95)
Part No. **1127** Transmitter Carrier
Part No. **1125** Wide Strap
Part No. **3082** PROFI transmitter tray
Part No. **3087** PROFI transmitter protector

Spare Parts
Part No. **4300.6** Telescopic Transmitter Aerial

Short Helical Aerial
Can be screwed on in place of the telescopic aerial contained in the Transmitter. See page 95.

Individual HF Transmitter modules
Part No. **4824.35** for 35Mhz band.
Part No. **4824.40** for 40Mhz band.

Individual Receiver C 16 S
Part No. **3867** for 35Mhz band.
Part No. **4067** for 40Mhz band.

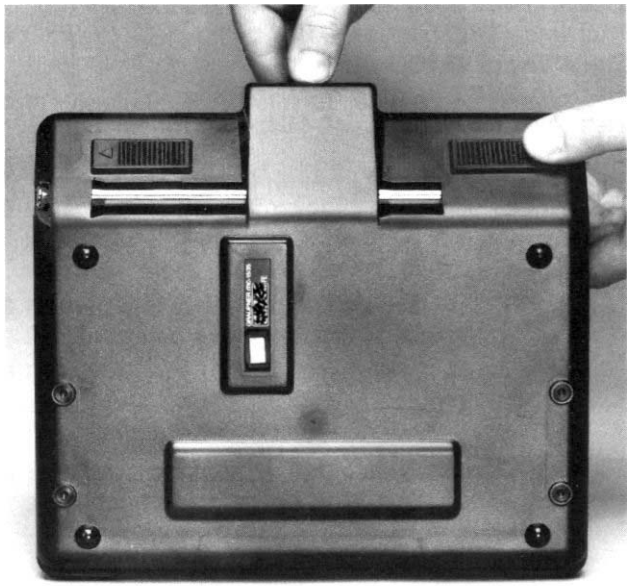
Further accessories – see the appendix and Graupner main catalogue.

Operating Instructions

Opening the Transmitter case

The removable back of the case is held by one locking catch and two interlock sliding catches.

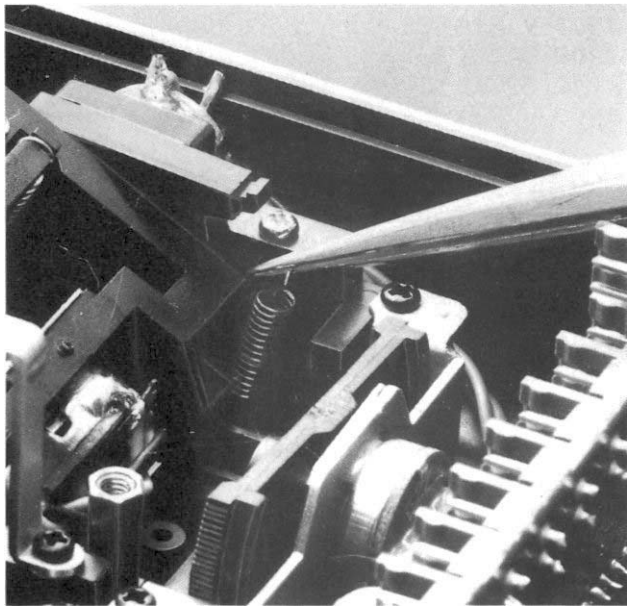
Before opening the Transmitter ensure the power switch is OFF. The sliding catches are moved against the direction of arrow (inward) until they hit the stop, then case back can be opened. To close, insert the case back into the housing at the lower edge. Push it closed and then slide both caches in direction of the arrow (outward).



Changing the proportional control sticks and changing the centring force.

Both vertical control stick directions can be changed between centring or non-centring (e.g. throttle on the right or left). With the transmitter open and at the appropriate centring lever, notice the feather/spring (figure below. Lift up the centring lever to be able to get access, remove and keep the spring.

In the case of mechanical conversion of the throttle function, an electronic conversion of the control functions must also be made using the code "MOD" during the basic transmitter programming, see page 15. The ratchet strap provided in the accessories is mounted to the two captive nuts on the inside of the control stick units (photograph on the right).



The resistance to movement of the control stick can be adjusted between low to high by tightening or loosening of the adjusting screw.

The centring force of the control sticks can be adjusted at the screws indicated in the figure by an arrow:

Clockwise rotation – centring force higher
Anti-clockwise rotation - centring force lower

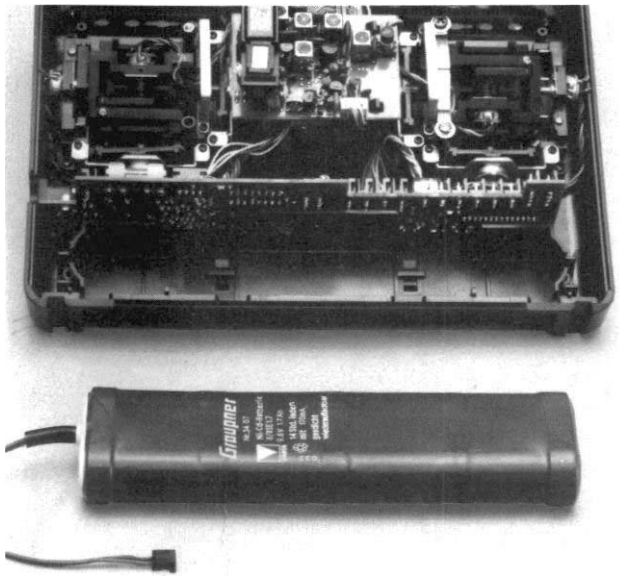
Power Supply
The battery tray in the transmitter is equipped with a 9.6v battery.

Different battery types are available to be selected. Into the battery mounting for the receiver, insert four AA cells of 1.2v and between 500 and 600mAh. Instead of the battery mounting, or in addition, a 4.8v battery with miniature plug can be used, see page 5.

Pay attention to the full battery voltage. If the rudder moves noticeably more slowly or display the goes under 9.6v back then stop operation and load new batteries (or recharge).

Charger devices and batteries - see Graupner main catalogue telex.

Your contribution to environmental protection:
Do not throw to used up batteries into the domestic refuse, but take these to an appropriate collecting point, in order for them to be recycled or disposed of in an environmentally friendly way.



Charging of the Transmitter battery
The rechargeable transmitter battery can be charged in the Transmitter using the socket on the side of the case. The set must be switched OFF while charging.

When using the automatic MULTILADER 5B or 6E the connection is made by charging cable Part No. 3022. For the MULTILADER 5 it is necessary to use the polarised charging cable Part No. 3040.

The remote control system is equipped with a reverse connection protection circuit for charging of the Transmitter battery. Thus damage is prevented by incorrect polarity or short-circuit. In order to disable this reverse current protection (e.g. for measuring purposes or when connecting an automatic loader), it is necessary that the enclosed two-pole plug link is attached directly to the link pins as short circuiting bridge.

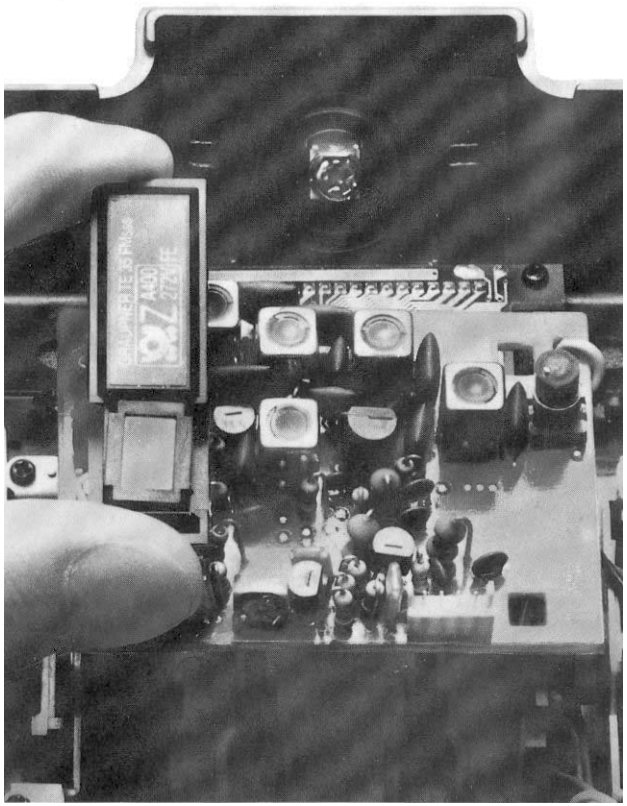
During rapid charging the transmitter battery charging current must not exceed 1.5A.

Charging the receiver battery.
The charging cable Part. No. 3021 for MULTILADERS 5B and MULTILADER 6E can used to connect the receiver battery directly to the charger. If the battery is in the model, then charging cables Part. No. 3023, 3046, 3377, 3934 or 3934,3 are attached making use of the connector integrated into the receiver switch harness. For the universal battery charger MULTILADER 5 the polarised charging cable Part. No. 3041 is necessary.

The period of operation of receiver batteries depends heavily on the battery type and on the frequency of servo movements and their load. In the PCM mode the "Fail Safe" function can be activated, which will display when the receiver battery falls below to a certain voltage, see page 25.

Operating Instructions

Frequency band and Channel change
Change frequency band: The Transmitter can be operated on different frequency bands by changing the High Frequency module. The removable HF module is held by four sprung pin fittings in the centre of the Transmitter. Two cables must be attached. Link **1** connects to the Transmitter circuit board. Link **2** connects the HF module to the aerial.

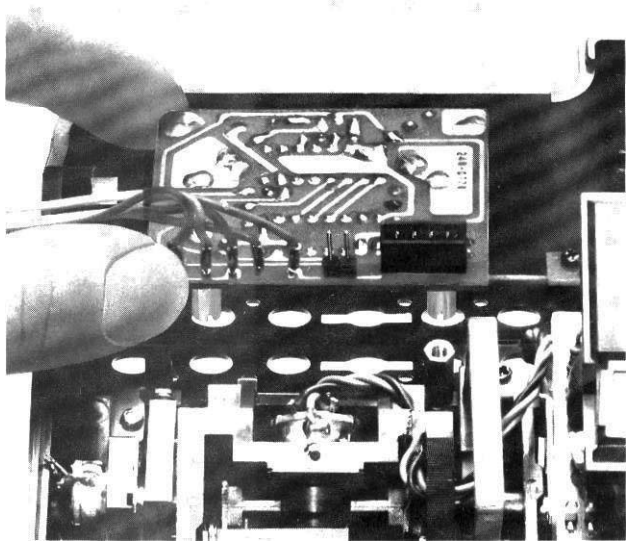


Changes of the HF channels: The channel is determined by the crystal. Only crystals of the correct type and the appropriate frequency band may be used (see page 98).

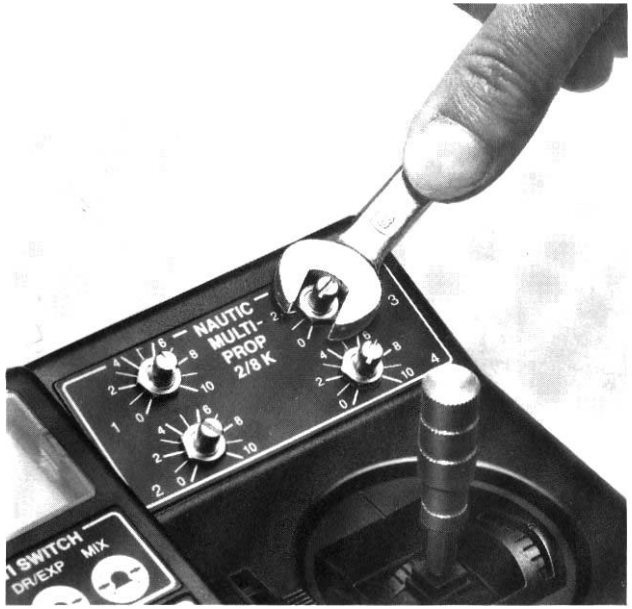
The Transmitter crystals “T” is put into the HF module. Frequency band and channel number of the crystal inserted must correspond with that in the Receiver.

Installation the Module
The Transmitter case is pre-drilled for the installation of the modules, like NAUTIC, Proportional and Switch Module. The blanking caps in the holes of the case can be removed pushing them outward with an appropriate object. To complete the assembly of the Proportional and Switch modules, Part. No. 4152 or 4151, they must be connected to the HF module.

The NAUTIC modules are installed by inserting the controls through the pre-drilled holes in the case (from the inside) (see next paragraph "fastening the modules"). Ensure that the connection socket of these modules points to the centre of the transmitter.



Fasten the NAUTIC modules
Insert the module into the intended location and that check it fits correctly. The protective plastic film on the printed fascia plate can be now taken off. Then remove the backing paper of the double sided tape and the attach the fascia plate lightly pressing it down. Insert the module from the inside into the prepared module location. The module is secured by fitting the washers and nuts to the potentiometers or switches and carefully tightening them with a suitable tool. Finally, mount the control knobs to the potentiometers so they correspond with the scale markings.

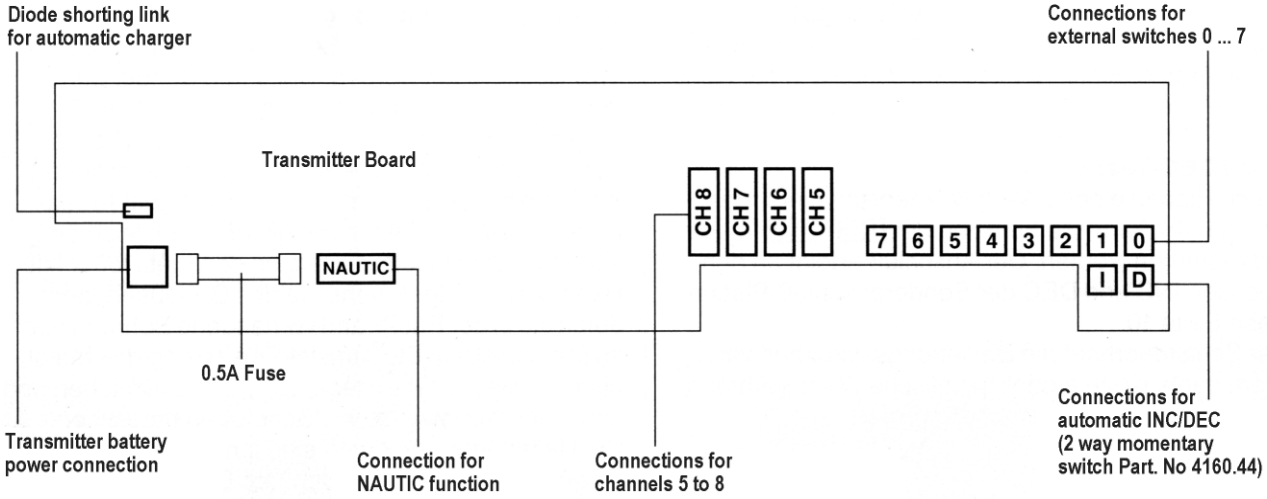


Length adjustment of the control sticks
The length of the control sticks can be adjusted up to the maximum length marking on the stick shaft.

INC/DEC Keys
By installation of a 2 way momentary switch, Part. No. 4160.44, the functions of the INC / DEC keys can be taken over. The connection is made to the sockets marked INC and DEC on the transmitter circuit board, see page 10.
The switch increases the operating ease, especially when model-specific values are programmed during operation.

Assembly of the Transmitter Carriers
The transmitter can be equipped with the transmitter mounting Part. No. 1127. Open the transmitter case and in remove the bottom blanking caps. The bottom of the case is already prepared for the assembly. The four mounting plate holes in the bottom of the case can be opened up by boring through using a screwdriver. From inside the case, insert the metal arms through the mounting holes. The plastic mounting plates are fed over the metal arms and screwed to the outside of the case, with two screws each. The carrier arms are strongly retained up a long coil spring. If softer folding of the carrier arms is required, the spring must be shortened accordingly.

Connection of External Control Elements



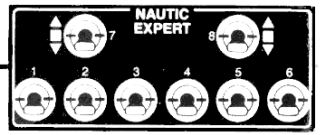
External Switch Connection	Model Type				
	Standard “FL”	Unifly “UN”	F3B/Butterfly “Fb”	Aerobatic “AC”	Helicopter “HE”
0	Dual-Rate and Exponential for: Aileron				Roll
1	Dual-Rate and Exponential for: Elevator				Pitch
2	Dual-Rate and Exponential for: Rudder				Tail Rotor
3	Combi-mix (Aileron ⇨ Rudder)				Autorotation
4	Mixer Elevator ⇨ Flap				Throttle Pre-set (Idle Up) Collective Pitch Curve
5	Mixer Flap ⇨ Elevator		Mixer Flap ⇨ Elevator	Auto-landing	Throttle Pre-set (Idle Up) Collective Pitch Curve
	Freely Programmable Mixer C				
6	-	Differential Mixer	Differential Mixer	Snap Roll	Static / Dynamic Torque Compensation
	Freely Programmable Mixer B				
7	-	Mixer Spoiler ⇨ Elevator	Butterfly ⇨ Aileron, Elevator & Flap Mixer	Snap Roll	Gyro Gain
	Freely Programmable Mixer A				

Module Installation Pattern

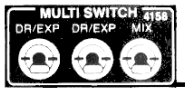
Function Modules

See page 91

NAUTIC-
Multi Prop. Module
Part No. **4141**

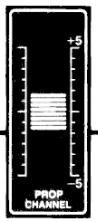


16 channel
NAUTIC Expert Module
Part No. **4108**



Multiple External
Switch Module
Part No. **4158**

2 channel
Switch Module
with long arm
Part No. **4151**
with short arm
Part No. **4151.1**

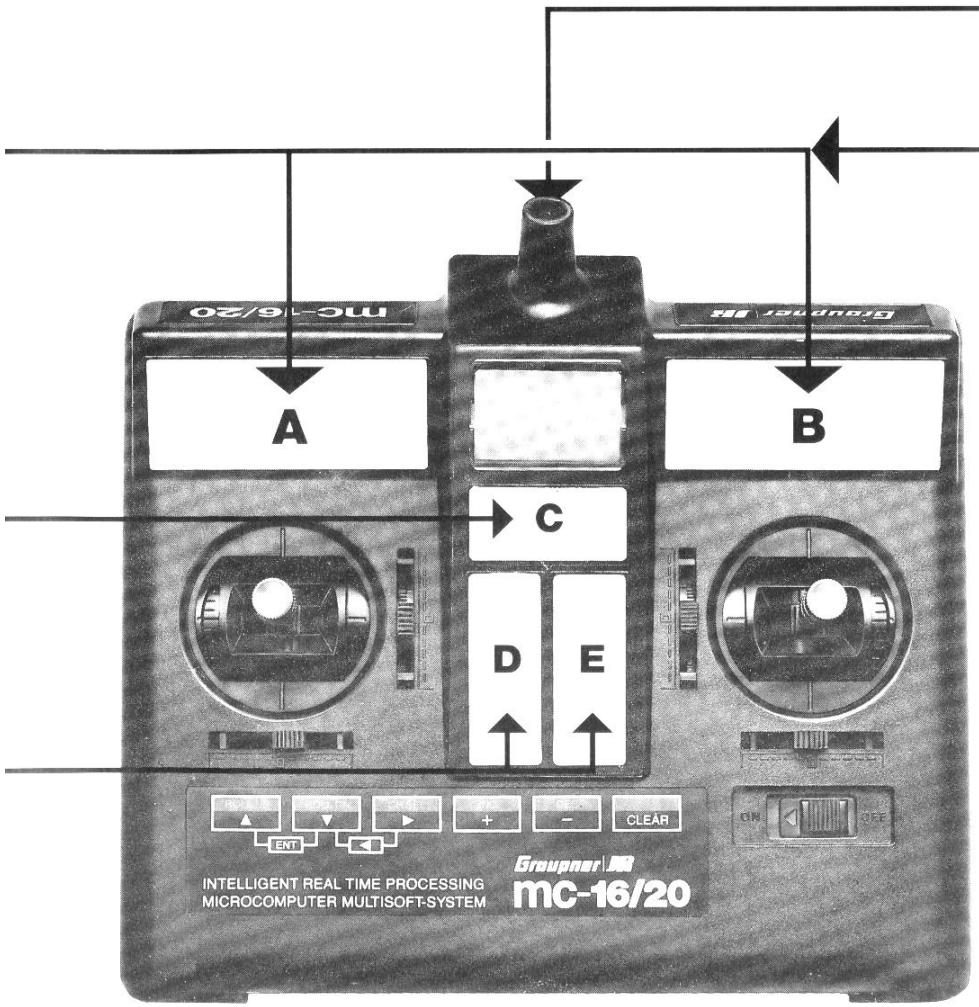


2 channel
Proportional
Module
Part No. **4152**

Switches, Controls

See page 91

Transmitter Modules



External Switch
with long arm
Part No. **4160** 1 way
with short arm
Part No. **4160.1** 1 way
Part No. **4160.2** 2 way
Part No. **4160.3** 3 way

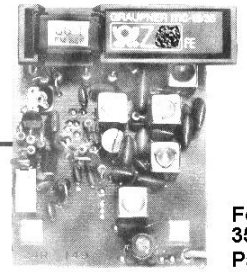
Momentary Switch
Part No. **4160.11**

Differential Switch
Part No. **4160.22**

2 way Momentary Switch
for Increment (INC) and
Decrement (DEC)
Part No. **4160.44**

External Safety Switch
Part No. **4147.1** 1 way
Part No. **4147.2** 2 way
Part No. **4147.3** 3 way

2 channel Proportional
Rotary Module
Part No. **4111**



For the
35MHz Band
Part No. **4824.35**

For the
40MHz Band
Part No. **4824.40**

Compatibility of Computer Systems mc-16/20

The mc-16/20 transmitter can be operated with all currently available Graupner FM PPM receivers, as well as other receivers with negative going pulses, from the 35 and 40 MHz frequency band. Slight reduction of servo travel can become countered by the transmitter up to a maximum of ±160%. Also the neutral position of servos attached receiver channels 1 to 8 can be adapted in ±125 steps, which is approximately ±70% of normal travel, for all 8 Servos.
In the mc-16/20 Transmitter an FM quartz crystal (black plastic cap) with corresponding channel number must be used.

Part No. **3864**, or
3264 for the 35 MHz band
Part No. **4064** for the 40 MHz band

Alternatively, the GRUNDIG receiver can be used, but it is to be made certain that these are equipped with a GRUNDIG FM quartz (green tab).

Basics

A protective plastic film is attached to the input keyboard of the transmitter, and can be taken off.

Only switch on transmitter with the aerial screwed in, otherwise it may malfunction and damage the HF module.

The allocation of the receiver outlets depends on the type of model selected, and is described on pages 28, 34, 42, 52 and 62.

In order to avoid uncontrolled movements of the servos attached to receiver outlets, first switch the transmitter on, then switch on the receiver. After the relevant operations switch off the receiver, then the transmitter.

Range Check
With a new model a range test on the ground, with the transmitter antenna screwed in but not extended, should be completed before the first flight. The model should be tested with the engine running and if available check the fail-safe operation.

Adjustment of the transmitter aerial
In the direction of the extension of the transmitter antenna, only a small field strength is formed. It is therefore wrong to point the antenna directly at the model.

Multi Data Terminal

Multi Data Information Display
The clear LCD MULTIDATA display with a static driver, was developed for the mc-16/20 Computer System. It offers a improved safety during operation, since all important functions are displayed. Even in bright sunlight, all the parameters on the display are represented in high contrast.

Possible screen-displays of the "Basic Transmitter Information":

- Normal operation

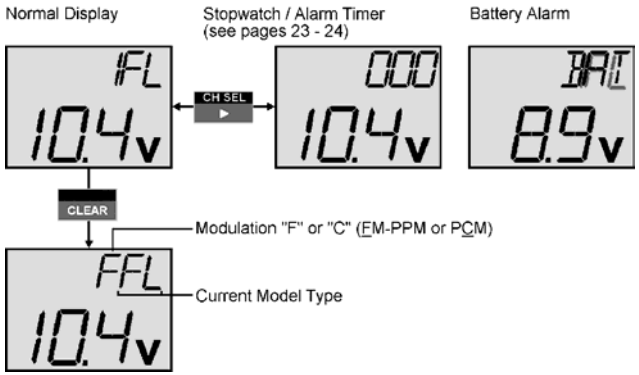
Three figure model name (or model number and type) and battery condition (under load) in volts. On pressing of the CLEAR key the current modulation mode is briefly displayed in place of the model name, as "F" (FM-PPM) or "C" (PCM) in conjunction with the type of model "FL, UN, Fb, AC or HE".

- Stop watch / alarm timer (see pages 23 - 24)

The upper display line changes, as soon as CH SEL is pressed.

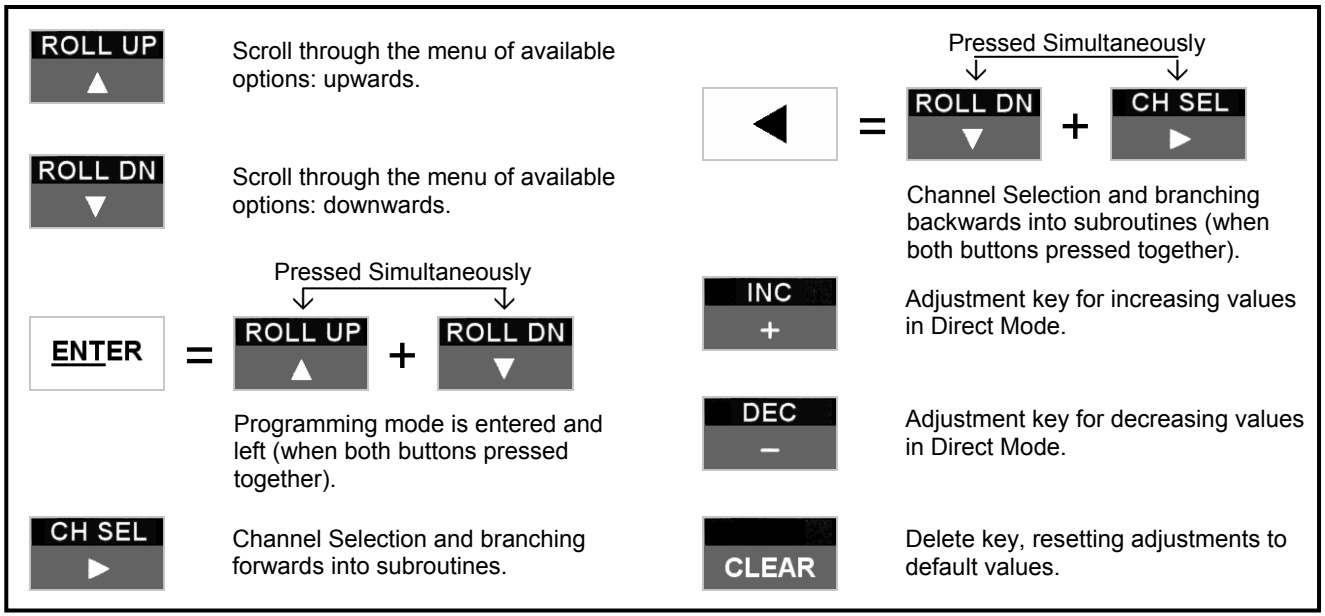
- Battery alarm

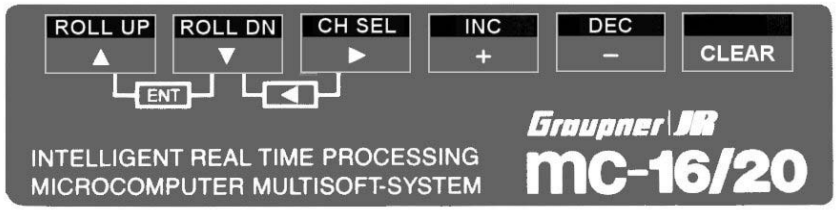
When the battery voltage drops under 9.0v the display alternating between the normal data and “BAT” caption. An audible warning signal sounds in parallel to it seven times consecutively. Landing of a model aircraft must made immediately after the "BAT" alarm display is reached, to allow recharging of transmitter battery.



Operation of the Multi Data Input Terminal
The program of the Transmitter is organised and uses only six keys for simple and clear programming. If a key remain pressed continuously, the instruction and setting codes automatically change with increased rate until the key is released.

Note:
The function of the INC and DEC keys can undertaken by a 2 way momentary switch, Part. No. 4160.44, which is connected to the sockets on the circuit board in the Transmitter intended for this function.





System Menu

Using the system for the first time and programming the basic transmitter data

Software Structure
The software is divided into two menus, which are activated in different ways.

1. System Menu
   Adjusting the basic transmitter functions.

2. Set-Up Menu
   Selecting, activating and programming the model specific data.

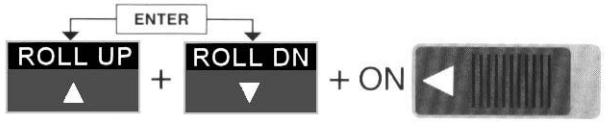
In each of these menus, the individual codes can be called up in rotation by the ROLL UP (upwards) or ROLL DN (Roll Down, downwards) buttons. When you reach the bottom code, the ROTART SELECT system returns you to the start of the list again, until you either leave the System or Set-Up Menu by pressing ENTER (ROLL UP and ROLL DN keys simultaneously), or by switching off the transmitter and thereby resetting it to normal operation.

To prevent accidental reprogramming, the System Menu can only be activated if the transmitter is switched off first. This makes it impossible for you to accidentally alter programmed these functions, e.g. switching model memory or changing modulation mode (FM-PPM/PCM), while you are using the system to control a model. Since the transmitter is not producing a modulated signal in this mode, it is impossible to transmit a signal to the receiver during this basic programming.

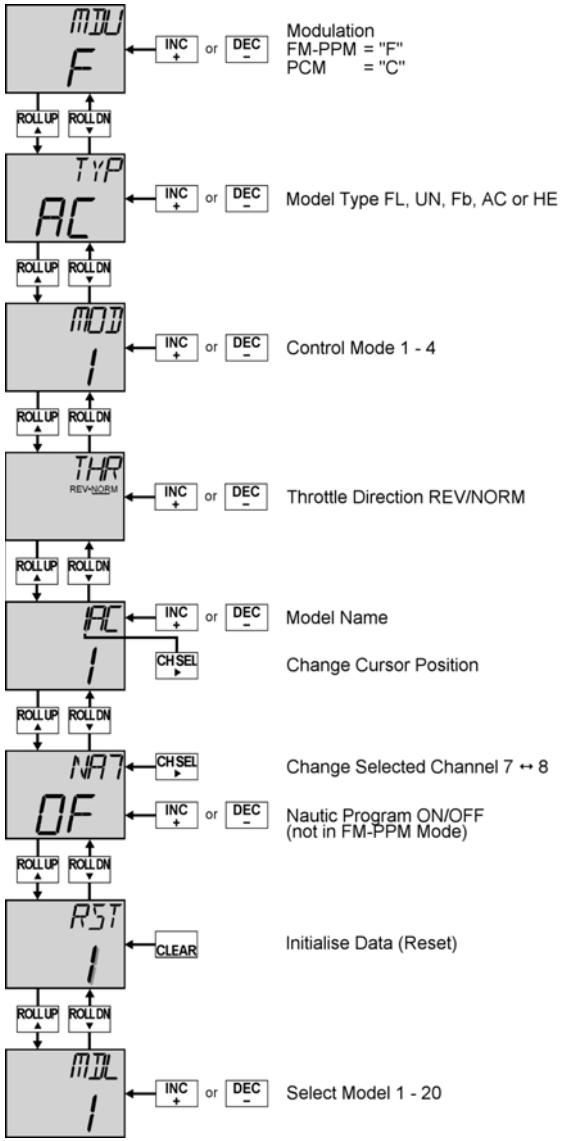
Basic method of using the System Menu

First you need to select the code you wish to alter by pressing the ROLL UP or ROLL DN button. Within this code, you select the function you require using the INC or DEC buttons.

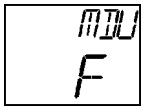
Entering the System Menu
Simultaneously press the ROLL UP and ROLL DN buttons (= ENTER) whilst turning the transmitter on. An acoustic signal sounds. The program is now in the System Menu. The accompanying flow chart shows the programs of the primary system, whose functions are shown in the transmitter display. By repeat pressing of ENTER the software leaves the basic programming and automatically returns to normal transmitter operation.



Block diagram of the System Menu



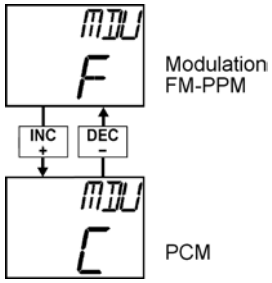
Leave the Menu at any place with ENTER.

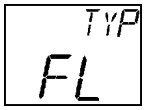


MODULATION MODE

Selecting the Modulation Mode
(access via System Menu)

The first option in the System Menu is to set the type of modulation. This varies depending on the type of receiver you will be using. The mc-12, mc-18, mc-20 and DS 20 mc are PCM types (Pulse Code Modulation) and are used with the transmitter set to PCM modulation. This is indicated by a letter “C” in the display. For FM (Pulse Position Modulation) receivers the transmitter must be switched to FM (PPM) operation, and the display will show an “F”. Switch from one to the other by pressing the INC or DEC buttons.



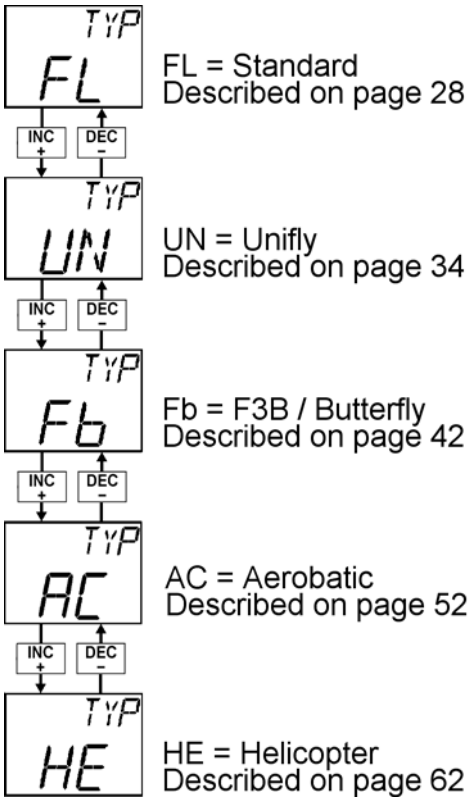


MODEL TYPE

Establishing the Model Type
(access via System Menu)

The mc-16/20’s Multisoft program differentiates between five different types of model. The selection must be made before re-programming a model using the Set-Up Menu (see later) because the menu determines which options can be called up by the Type. A summary of the five ready-made multi-function programs is on pages 26 – 27.
Your reach this code using the ROLL UP button. Five model types are available, each selected with the INC or DEC buttons. If you change the current model type using the INC / DEC buttons the new model type will flash in the display. It is not adopted until you confirm the selection with ENTER (ROLL UP + ROLL DN). When you confirm the selection, all the options in the Set-Up Menu will change accordingly. All the original set-up parameters of this memory will be lost when changing model type. If necessary, you can return to the current model by pressing the INC, DEC or CLEAR buttons before you press enter.

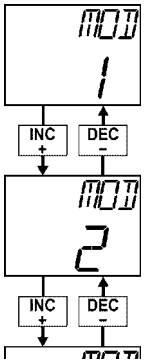
Summary of the ready-made multi-function programs



CONTROL MODE

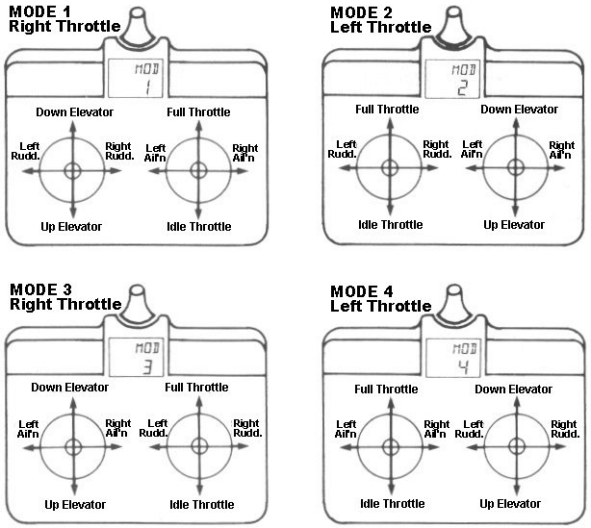
Transmitter Stick Functions for Channels 1…4
(access via System Menu)

Activate the System Menu and select “MOD” by pressing the ROLL UP (or ROLL DN). You can now change to mode 1 – 4 using the INC or DEC buttons. All other functions are automatically matched to the stick mode you have selected.



Modes 1...4 available

Stick Modes – Fixed-Wing Aircraft



Stick Modes – Helicopter (see page 66)

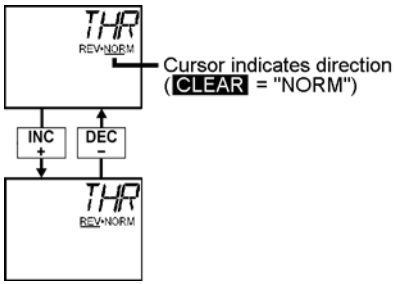
Throttle = Collective Pitch Elevator = Pitch
Aileron = Roll Rudder = Tail Rotor

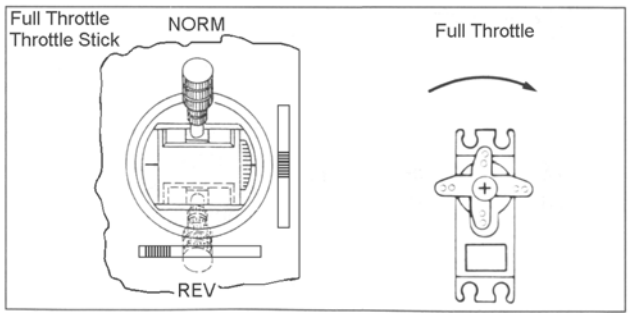
THROTTLE DIRECTION

Reversing the Direction of Throttle Control
(access via System Menu)

This reverse function is effective for all model types. This code provides a means to alter the direction of operation of the throttle stick (transmitter function 1) to suit your preference. You can toggle between "NORM" and "REV" by pressing the INC or DEC buttons.
There are several mixers which involve the throttle (function 1), and they can only work correctly if this setting is correct. In the helicopter program this means that throttle and collective pitch functions, e.g. throttle idle-up, tail rotor mixer, collective pitch trim, etc.
The idle trim is automatically switched to the other end of the stick arc when you reverse this function.

Important:
The effect of the idle trim system is that the trim slider for the throttle servo has no influence around the centre position and at the full throttle end of the stick arc.

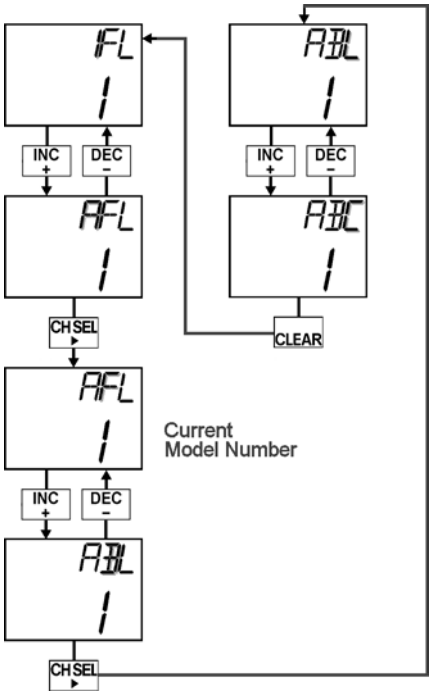




MODEL NAME

Entering the Model Name
(access via System Menu)

When you first select a model (or after a reset) a standard 3 character entry appears in the display above the model number. Example: 1FL, 19L, …
Model number 1 – 20 and current model type (FL = standard, UN = Unifly, Fb = F3B / Butterfly, AC = Aerobatic, HE = Helicopter).
The left-hand character flashes and can be changed by pressing the INC or DEC buttons. The characters available are A – Z, 0 – 9, + and –.
You move to the next character by pressing the CH SEL button. The name entered is stored as soon as you leave this code.
(For model numbers 10 – 20, only the last letter of the model type is displayed).



NAUTIC PROGRAM

Connecting Nautic Modules (only in PPM Mode)
(access via System Menu)

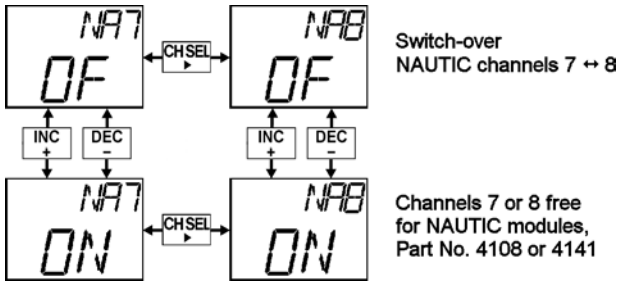
The "NA" function can only be selected if the transmitter is set to PPM mode.
Switching the NAUTIC function on using INC / DEC automatically reserves transmitter channels 7 and 8 exclusively for the NAUTIC module. Any mixers which involve channels 7 or 8 are automatically blocked, as the channels used by a NAUTIC module cannot be linked with other channels using a freely programmable or ready-made mixer (see block diagrams).
The channel number after the letters "NA" indicates which channel can be used.

Model Type	NAUTIC channels
FL (standard)	7 and 8
UN (Unifly)	7 and 8
Fb (F3B/Butterfly)	8 only
AC (Aerobatic)	8 only
HE (Helicopter)	8 only

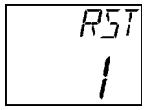
You can switch to the second channel by pressing the CH SEL button. More information on installation is included in the Appendix, page 82.

Note:
When using the model types "AC" and "HE" channels 5 and 7 can also be used for NAUTIC modules if necessary, in addition to the NAUTIC code.

Servo Reverse (see page 21)	NORM.
Servo Neutral (page 21)	0
Servo Travel (page 21)	±146%
AC: "Auto-landing" Code if ch 7 used (pages 54, 57)	off
HE: "Gyro Control" Code if ch 7 used (pages 61, 65)	off
HE: "Swashplate Type" Code if ch 5 used (page 66)	N, 2 or 3



NAUTIC multi-function facilities, see section starting on page 83



DATA INITIALISATION

Reset, erase data & reprogram the basic values
(access via System Menu)

Before you re-program a model memory, you should reset all data using this code in order to ensure that all parameters and functions are reset to the default settings.
When you select the “RST” function, the number of the model memory in the bottom line of the display flashes. This is the memory whose settings are to be erased. The actual erasure occurs when you press the CLEAR button. As soon as the model number ceases to flash the erasure has taken place.

Re-initialised data after reset:

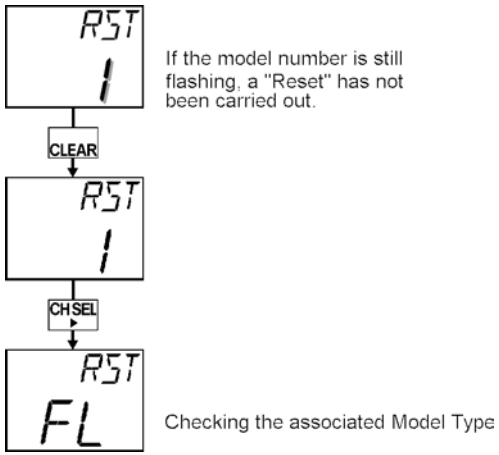
In the System Menu:

Model Name	Model number and current model type
Throttle Direction	Normal (“NORM”)
NAUTIC program	off (“OF”)

The settings for type of modulation, model number, stick mode and model type are unchanged.

In the Set-Up Menu

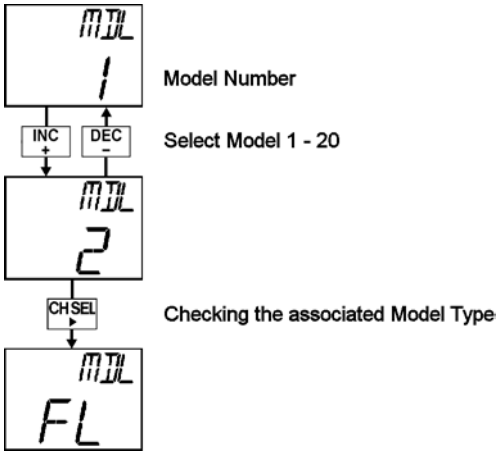
Dual-Rate	= 100%
Exponential	= Linear (“LN”)
Servo Reverse	= Normal (“NORM”)
Servo Neutral	= 0
Servo Travel	= 100%
Mixer Values	= Initial default values



MODEL SELECT

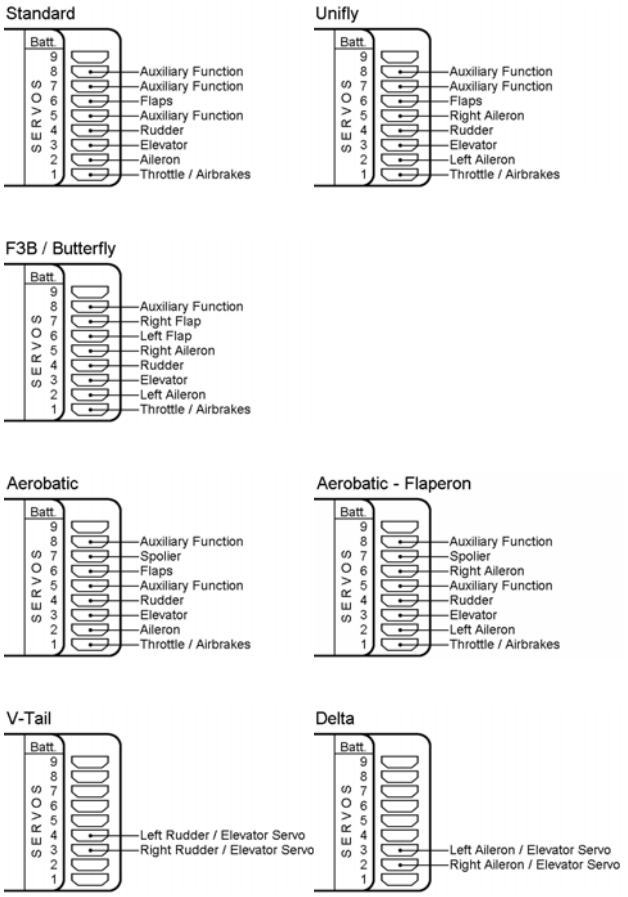
Switching Model Memory 1 – 20
(access via System Menu)

The mc-16/20 transmitter allows you to store all the settings for 20 different models.
After selecting the System Menu code “MDL”, by pressing the ROLL UP or ROLL DN button, press the INC or DEC buttons to select the model. All the adjustments which you subsequently make will then apply to the model number displayed in this menu.
The model type can be called up in the display by pressing the CH SEL button.



Receiver Connections (Channels 1 – 8)

The servos must be connected to the receiver outputs as shown in the diagrams below:



See the Helicopter section for those connections.

Set-Up Menu

General notes
You have concluded the basic programming of the transmitter. If no special functions, like servo travel adjustment, servo reversal, mixer and coupling function etc., are necessary, you can now already put your model into operation. Look up the basic outline of the multi-function finished programs on page 26 and 27, or test them using the detailed descriptions for the model type used.

Model Type	See page
Standard (FL)	28
Unifly (UN)	34
F3B/Butterfly (Fb)	42
Aerobatic (AC)	52
Helicopter (HE)	62

The modelling beginner is recommended to choose models with control over rudders and elevators, and if necessary also over Ailerons. Select the standard model type "FL" in the system menu.

Flow charts and block diagrams
Those the individual sections placed in front flowcharts contain the available in each case codes. (see page 19).
From the block diagrams it can be inferred, in which place in the signal flow from the signal of the controls, i.e. can be influenced and changed between the control functions 1 – 8 and the receiver connections. For clarity the same designations and abbreviations were used as with respect to the descriptions of code. See the diagram below.
The controls at the transmitter are symbolically explained by the character . The control sticks 1 – 4 additionally possess a (electronic) trim.

Since these are not influenced by the dual rate and exponential function, their signal process is drawn separately. The cross connections show, which channels are linked together with certain finished programs. For the freely programmable mixers, see page 22 and 23, of importance are the "output point" and the " input point ". The program in the appropriate place tests, at which point in the signal flow a signal is to be measured (outputs) and which channel it is to affect (inputs).
Before the signal finally arrives at the receiver or at the servo, it can still be influenced by the servo travel, reversal and neutral adjustment.

Block Diagram (Partial View)