

Description of circuit functions:

The Profi 4000 is a micro-controller controlled radio control transmitter consisting of the following standard modules: processor, ROM, RAM and multiplexer. Communication with the user is via an LCD screen with 4 x 20-character lines and an 8-key keypad.

The RAM is powered by a lithium battery when the unit is switched off. When the system is switched on a processor monitor circuit (MAX 691) produces a reset signal, and also controls the voltage transfer between the lithium battery and the main battery at the RAM module, at the same time automatically blocking access to the RAM. This arrangement eliminates the danger of data loss or undefined data writing to memory. A voltage sensor in the same IC generates a Low Batt. signal for the processor.

The system controller is a Motorola 68HC16 micro-controller running at an internal clock speed of 16 MHz. Its task is to register all stick and switch signals and carry out the overall signal processing. Furthermore it is responsible for communication with the user and with external peripheral devices. The load on the 68HC16 is reduced by the use of a second micro-processor (Texas TMS 370) whose sole purpose is signal preparation; it runs at the same clock speed as the 68HC16.

The program is stored in a 64KBx16 EPROM. With this type of EPROM only 16-bit word access is possible. The model memory consists of two RAM modules each with a capacity of 128KBx8. The RAM is organized in such a way that byte access is possible in addition to word access.

The integral A/D converter of the 68HC16 features 8 inputs. Four further analogue multiplexers (HEF 4052) are included in the circuit in front of these inputs, in order to increase the number of analogue inputs to 32. The A/D converter is a 10-bit resolution device.

The external analogue inputs are divided up as follows:

- 4 proportional inputs from the dual-axis stick units
- 4 trim sliders associated with the dual-axis stick units
- 8 proportional inputs
- 12 switch inputs
- 1 keypad input
- 1 battery voltage input
- 1 lithium voltage monitor
- 1 field strength input from the monitor receiver

The system reads in keypad values in analogue form in order to minimise wiring. The keypad consists of eight keys, each of which alters the value of a voltage divider. This produces 9 voltages of which 8 are assigned to one button each. The 9th voltage is left open, i.e. no button pressed.

The system reads in switch states in exactly the same way. The inclusion of voltage dividers allows the use of 2-stage, 3-stage or 5-stage switches.

Since the number of available port channels is not sufficient to cover all functions, the circuit includes port expansion based on a 74HC373 latch module. This is a memory module providing temporary storage for 8 output stages. Two of these modules are used, and thus provide 16 additional output port channels.

An analogue multiplexer (HEF 4053) is also employed to gain a further three input paths.

The LCD screen is controlled via the port channels of the micro-controller. 8 data lines and 3 control lines are required.

Operating the On/Off switch sends a control signal to the micro-controller, and the processor then saves its data before automatically switching off the system with a delayed action. This arrangement prevents the transmitter being switched off in an uncontrolled manner, with the associated data loss in the model memory which was last altered.

The system also includes connections for:

monitor receiver module

The signal packets required to modulate the RF module, the diagnosis signal and the teacher-pupil signal are generated by the TMS 370. The modulation signal is fed to the RF module via a transistor inverter. A signal input only releases the teacher-pupil signal if the RF module of one transmitter has been disabled by switching off its oscillator voltage. This ensures that only one transmitter radiates an RF signal.

The RF module is also switched off if the diagnosis plug is connected to the transmitter.

A multi-colour LED is employed to monitor the status of the transmitter; it provides a visual indicator of the following modes of operation:

red	-	RF off (e.g. diagnosis operation etc.)
green	-	RF on - normal transmitter operation
yellow	-	RF off - monitor receiver on

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Description of the RF - module HFM 3-72 Mc

Specification of the crystal controlled transmitter:

Power supply :	7.2 Volts (6 NI - Cells)
Input current :	up to 220mA(Transmission Mode)
Mode :	FM (F3D)
RF - output power (ERP) :	350 mW
Deviation :	1.60 Kc (PPM9)1.85 Kc (PCM12)
Crystal specification :	

Transmitter part of the HFM 3 - 72Mc :

The transmitter consists mainly of an rf - amplifier unit (4 stages) . First stage is a ordinary crystal oscillator using a varicap diode for modulation. Next stage is a puffer with a low amplification rate.

The driver stage using a dual MOS-Fet amplifier for final input level.

The rf - output of the final stage is filtered and matched to the antenna.

The digital control data (of ppm or pcm typ) are limited in frequency range by an activ low pass audio filter combination before modulating the crystal oscillator stage.

The cut off frequency of the low pass filter unit allows to transmit very different control data's without interfering other receiving channels .

The deviation and power output adjustment is fixed while final testing.

The transmitter unit is able to perform all basic control data types such as PPM 7, PPM 9 or PPM 12 also including different PCM - types which can be chosen by the basic μ P controlled RC - System P4000 or P3000.