CycLock 1

CCPM manager

A real alternative to expensive in-transmitter mixing

Eliminates RC system latency errors.

Exploits full resolution of the RC link.

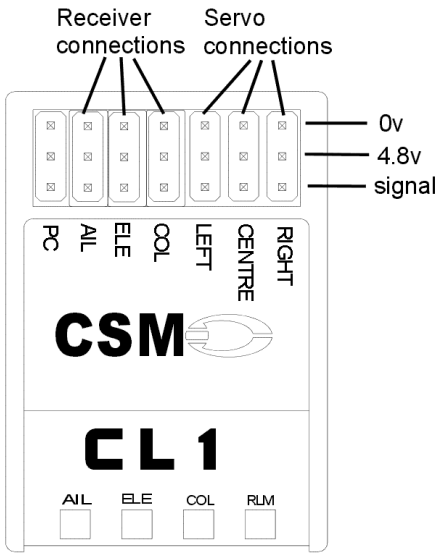
Corrects for CCPM geometry errors.

Optionally drives servos at digital rate - twice the speed of the best in-transmitter system.

Electronic cyclic ring - works with exponential, rates, and even mode 1 fliers (unlike physical ring)

And is the gateway to electronically stabilised flybarless operation

Mixer connections



Connect the unit to the receiver and the swash-plate servos as indicated. Once the unit has been powered up you will also need to connect the unit to the PC via a CSM LPT interface cable or a CSM USB adapter in order to adjust the mixer settings.

Installing the interface
Insert the CD and run "**Install CycLock1.exe**" and follow the onscreen prompts. This should install all the required files and put a shortcut on your desktop. If you are going to use the CSM USB adapter this will trigger its own installation on first being connected to the PC. For convenience the install program copies the required driver files onto the hard disk of your PC. Copies are also available on the installation CD.

Connecting the interface to the mixer
To run simply double click on the Shortcut to CycLock on your desktop. Power up the receiver and then connect the PC interface cable to the mixer.

Select the required **PC to mixer port** (LPT1-4 or USB as appropriate)

Click on "**Connect to Mixer**"

This should establish the link between the PC and the mixer. Any changes to the settings will be immediately written back to the mixer. Once changes to the settings are complete allow a few seconds for the last changes to be written to the mixer and then disconnect the interface cable before powering down the receiver.

Set-up procedure
This procedure is designed to set the mixer to give correct interaction-free operation of the swash-plate at the maximum control throws. Once the procedure is complete you may wish to restrict the control throws in some of your flight modes using the rates and/or ATV facilities in the transmitter.

Transmitter settings
Turn off CCPM mixing in the transmitter. The CSM mixer takes separate collective, elevator and aileron signals and performs all the mixing functions for CCPM.

Setting the sense of the controls
Set the **servo reversers** in the transmitter so that:-

- The **"AIL"** LED comes on solid for **RIGHT** aileron.
- The **"ELE"** LED comes on solid for **FORWARD** (nose down) elevator.
- The **"COL"** LED comes on solid for **UP** collective.

On **Futaba** this usually requires the **elevator** and **collective** channels to be **reversed**.
On **JR** transmitters this usually requires the **aileron** channel to be **reversed**.

Setting the travel adjustments
Set the **travel adjustments (ATVs)** to the **maximum** (typically 140 to 150%) for **both directions** of throw on **collective, elevator and aileron channels**. This will make best use of the available resolution of the radio system. A software 'cyclic ring' limiter is built into the mixer to prevent linkage over-travel for combined aileron and elevator deflections.

Setting the collective pitch curve
Set the pitch curve to be linear running from **0%** at fully down, **50%** at mid stick and **100%** at fully up.

Setting the trims
Centre aileron and elevator **trims and sub-trims**.

Mixer settings
Set the **Mid Stick pulse length** to match your radio system. This is **1500** for **JR** and **Sanwa** and **1520** for **Futaba** and **Hitec**. Note that the **"AIL"** and **"ELE"** LEDs flash when their respective signals are within a click of trim of the set mid stick value so you should find that with the cyclic stick centred (and no trims set) both these LEDs should be flashing. If not then check that no trim or subtrim is being used on these signals and, if needed, slightly adjust the mid stick value in the mixer until both these LEDS are flashing. (If this is not possible then the transmitter is somewhat out of adjustment and in this case a small amount of subtrim should then be used to align the aileron and elevator signals to correct for this)

Set **Swash-plate phase correction** to zero

Set **Swash-plate servo type** to match the type of servos in use (if in doubt use "standard")

Set the **Servo speed** value to match the stated speed of the swash-plate servos at the voltage you are using. This is used to prevent transient elevator to collective interaction in 120 degree CCPM systems due to the greater distance travelled by the centre servo in elevator operation.

Set the eight **servo sense** controls to make all three servos move in the correct direction for collective, elevator and aileron controls.

Now centre the collective control. The **"COL"** LED will flash when the collective signal is centred.

With the collective centred:-

- Adjust the **Trim** values for each servo to level the swash-plate in the middle of its travel.

- Adjust the **elevator gain** values to obtain the correct elevator throw and to remove any aileron or collective change with elevator control.

- Adjust the **aileron gain** values to obtain the correct aileron throw and to remove any elevator or collective change with aileron control.

If you have any difficulty in achieving these requirements read the **"Initial linkage adjustments"** section at the end of this manual.

With the collective fully UP:-

- Adjust the **UP collective gain** values to obtain the correct positive collective pitch range and to level the swash-plate in its fully up position.

- Apply full left and right aileron while watching for any tendency for the swash-plate to tip forwards or backwards (Aileron to elevator interaction). Note in this type of interaction both left and right aileron deflection cause the same direction elevator movement (e.g. back elevator for both right and left aileron). If needed adjust the **Aileron to elevator interaction corrector for UP collective** until no elevator effect is seen with aileron deflection.

- Now observe if there is any tendency for the collective pitch to change with application of the aileron control. Note in this type of interaction both left and right aileron tend to cause the same direction of collective change (e.g. Reduction in collective for both left and right aileron). Remove any such tendencies by adjustment of the **Aileron to collective interaction corrector for UP collective.**

- Now apply full forward and back elevator and observe any change in collective. In this type of interaction both forward and back elevator cause the same direction of collective change (e.g. Reduction of collective for both forward and back elevator). Remove any such tendency using the **Elevator to collective interaction corrector for UP collective**.

With the collective fully DOWN:-

- **a)** adjust the **DOWN collective gain** values to obtain the correct negative collective pitch range and to level the swash-plate.

- b) Adjust the **interaction correctors for DOWN collective** to remove any Aileron-elevator, Aileron-collective and Elevator-collective interactions as described for the UP collective position.

This completes the set-up procedure.

Flight testing
Minor adjustments to the settings should be made in the light of flight tests. Two typical adjustments are:-

In upright full climb helicopter moves to your right.
Correct by increasing the **UP collective gain for the right servo** and decreasing the **UP collective gain for the left servo.**

In inverted full climb helicopter moves to your left.
Correct by increasing the **DOWN collective gain for the right servo** and decrease the **DOWN collective gain for the left servo.**

The last adjustment to make is the **Swash-plate phase correction.** Swash-plate phase errors cause aileron to elevator and elevator to aileron interactions of a circular type in one of the following two patterns:-

Forward elevator causes some right roll
Right aileron causes some nose up
Back elevator causes some left roll
Left aileron causes some nose down

OR

Forward elevator causes some left roll
Right aileron causes some nose down
Back elevator causes some right roll
Left aileron causes some nose up

Do not get confused between swash-plate phase errors and CCPM interactions. The CCPM aileron to elevator interaction causes the same direction of elevator effect (say nose up) for both right and left aileron controls Phase errors cause opposite elevator effects for left and right aileron.

Further information on the mixer controls

Mid stick pulse length
This value is used by the mixer to identify the crossover points between low and high collective etc and should simply be set to the same value as used by the radio system. Almost all systems available today work on 1500 or 1520us. If you are unsure which value to use proceed as follows:-

set an initial value (say 1500). With the aileron stick, trim and subtrim centred switch the aileron sense reverser for the right servo between normal and reversed and observe any movement of this servo. Adjust the value of Mid stick pulse length until no discernible servo movement occurs as the reverser is changed. This has now aligned the mixer pulse centre to the radio system.

Servo sense controls
There are eight servo sense controls (three each for the left and right servos and two for the centre servo). These are designed to accommodate a number of possibilities:-

Servo rotation sense (some give clockwise rotation with increasing pulse length while others give anticlockwise rotation for increasing pulse length.)

Which side of each servo arm the output is taken.

The centre ball at the front of the swash plate or the rear .

It is only necessary to switch the sense of these controls until the swash-plate moves in the correct direction for the collective, elevator, and aileron controls.

Trims
There are three trim controls; one for each servo. Before adjusting these values you should rotate each servo arm around on the servo shaft to find the arm position that puts the arm closest to right angles to the pushrod with the controls centred and these trims at zero.

UP Collective gains
These three controls are used to get the correct servo travel to achieve the right value for the full collective pitch. In general, with a well designed and set up linkage and well matched servos the swash-plate should be level at the fully up collective position when all three values are the same however minor differences in servo characteristics and imperfections in the linkage my require slightly different values to be adopted for the different servos in order to achieve the level swash movement required. If gross differences in the three values are required the reasons should be investigated and rectified if possible.

DOWN collective gains
These are exactly analogous to the UP collective gains described above but are operative when the collective is below the mid point. Adjustment should be carried out at maximum negative pitch.

Elevator gains
120 degree CCPM systems
For 120 degree CCPM initially set the elevator gain for the centre servo to be double the elevator gain for the left and right servos. While maintaining this ratio adjust the values until the correct maximum elevator throw is achieved. Then make minor adjustments to the centre servo gain to minimise any tendence to get, say, up collective with forward elevator.
140 degree CCPM systems
For a 140 degree CCPM system the three elevator gains will all be very similar. In adjusting these values you are trying to achieve the correct maximum elevator throw. Remove any tendency for the swash-plate to tilt sideways (in the aileron direction) by adjusting the relative values for the left and right servos.

Initial linkage adjustments
Despite the extensive controls provided by the mixer there is no substitute for careful initial adjustment of the linkages. This is best assessed when the controls are all centred (with "AIL", "ELE" and "COL" LEDs flashing).

It is important that, where possible, the servo arms are at right angles to the pushrods and where intermediate bellcranks are used that these are also at right angles to the pushrods (on both the servo to bellcrank and bellcrank to swashplate sides).

Where the physical layout of the model does not permit this ideal situation you should at least try to arrange that for each servo equal servo movements either side of the centre position causes equal vertical movements of the swashplate balls. Adjustment of servo centre trims and pushrod lengths should allow you to achieve this.

Errors in the linkage adjustment can cause problems with setting the elevator gains or aileron gains with the collective centred. A typical problem is as follows:- With the elevator gains set so that forward elevator gives no collective swashplate movement, back elevator then gives rise to a collective movement of the swashplate. This sort of problem can only be removed by adjustment of the linkage (with adjustment of the servo trims in the mixer as required)

Notes on 720 gyro setup for Cyclic operation

The attached setup assumes that the gyros are being used with the CycLock mixer set up as per the standard instructions (i.e using 140 – 150% ATVs on the cyclic channels). The tests that produced these settings were on a helicopter with about +-10 degrees of cyclic pitch range.

Mounting the gyros

Mount the elevator gyro so that its connectors are pointing sideways in the helicopter.

Mount the aileron gyro so that its connectors are pointing forward (or backwards) in the helicopter.

Connection of the gyros into the system

Elevator gyro
Connect the servo output of the elevator gyro to the elevator input of the CycLock mixer.
Connect the "RUD" input of the elevator gyro to the elevator output of the receiver.

Aileron gyro
Connect the servo output of the aileron gyro to the aileron input of the CycLock mixer.
Connect the "RUD" input of the aileron gyro to the aileron output of the receiver.

Gyro gain control
Link the gain inputs of the elevator and aileron gyros together using a "Y" lead and then connect them to a spare axillary channel of the receiver (e.g. Channel 8). Alternatively, if you have two spare axillary channels you could use separate gain control channels for each gyro.

Basic gyro setup
Set the midstick pulse width in the gyros to match the centre of the Tx. (This will give zero creep of the cyclics in Mode 1 with the sticks centred)

Set the servo speed parameter to match the speed of the CCPM servos.

Note that the the two modes are the same except for the HL decay time. I believe that Mode 0 with the short (1second) decay will be right for take off and hovering while mode 1 will be right for aerobatics as the HL term will act to cancel out any pitching tendency of the helicopter in fast flight (be it forwards or in any other direction)

The initial Tx gain should be set to about 60% with the expectation that it should be possible to increase this quite significantly before any instability sets in. A high speed oscillation will be due to an excess of conventional gain while a low frequency oscillation will be due to too much HL gain.

The stick deadbands and stick expo sensitivity are very much a matter of taste.

Weight:	16g
Dimensions:	27mm x 38mm x 16mm high
Supply voltage range:	3.3v to 8.4v**

** Warning: Check your RC system voltage limits as these will be more restrictive.

Spares, repairs and servicing

CSM0032	Pair 100mm leads
CSM0033	Pair 200mm leads
CSM0034	Pair 300mm leads
CSM0035	Pair 400mm leads
CSM0036	Pair 500mm leads
CSM0029	Mounting foam (6)
CSM0015	LPT interface
CSM0049	USB interface

Manufactured in the UK by
CSM Design Consultancy Ltd

For repairs and servicing please contact:-

CSM Service Department, PO Box 101, Glossop, SK13 5ZW
Tel. +44 (0)1457 854680, email tech@csm-ltd.co.uk
Website: www.rcmodels.org/csm
From outside the UK, please contact CSM for servicing details.

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