## The Synchroniser System

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Introduction

This section describes the operation of the G Series Computer when equipped with an Adams Smith 2600 or Q.Lock 3.10/4.10 synchroniser system. Alternatively, intelligent synchroniser interfaces, such as the Timeline Supervisor and Motionworks Motionworker, may be interfaced to the G Series Computer. Both these devices require the addition of a synchroniser.

To make the most of the system facilities, an understanding of basic timecode use is essential, and in this section, familiarity with the SSL G Series Computer is assumed. If you are new to timecode, refer to Appendix II for an introduction to the subject.

The G Series Computer uses timecode and tach pulses, from the tape machine under its control, to locate to reference points in the recorded material and record mix data from the VCA faders. By adding the synchroniser option to the system, up to five machines can be used synchronously, so that sound tracks can be referenced to film and video, or vice versa. Additionally, multitrack ATRs can be played synchronously to increase track capacity and facilitate mix-downs.

Having specified the parameters which define the machines you want to control, operation of the synchroniser system is simple. This is accomplished with a few short command lines entered via the computer keyboard, which in turn govern a very powerful and flexible machine control system.

System Components

The main components of the system are:

The Synchroniser consists of a generator, timecode readers and machine control interfaces for up to 5 machines.

Synchroniser Status Panel provides machine selection and record enable/disable pushbuttons, in addition to status indicators for up to 5 machines.

The Z8 Satellite Computer* processes commands, communicates with the synchroniser and returns data to the main computer.

Master Transport Selector* directs the console remote control to the master machine from the main computer.
Synchroniser Interface*  Timeline or MotionWorks - interface between the SSL Computer and synchroniser

* Note that Adams Smith and Q.Lock systems use the Z8 Computer and Master Transport Selector. Timeline and Motionworks systems do not.

Principles of Operation

The synchroniser system allows up to five machines (A,B,C,D,E) to be controlled in chase synchronisation mode. This is called 'chase lock', where one machine is designated the master, and is controlled directly from the remote transport controls on the console. The timecode track is read from the master and is fed to the master reader in the synchroniser. The other slave machines in the system are then controlled by the synchroniser so that their timecode output is synchronous with that of the master. As the master machine is operated, the other machines effectively chase it. Only machines A, B and C can be designated as system masters.

It is often necessary to start the various machines at different positions in the timecode sequence and to establish synchronous operation of the machine whilst maintaining a fixed time interval between their timecode tracks. The time interval is referred to as an offset, and when using the SSL Synchroniser System, offsets can be entered for each machine down to sub-frame resolution. Alternatively, mark points can be set up which represent identical points in the recorded material and the offsets are calculated automatically from these. In practice it is easier to work with mark points, especially when aligning tapes at the start of a recording session but, for post production work, offsets may have been previously specified.

The Synchroniser Setup page in the Setup Menu has an option ('Synchroniser In Use') which determines whether the system selects SYNC ON or OFF on loading the Program disc. The subsequent choice can be made by using the SYNC ON/OFF commands. In SYNC OFF mode the SSL Computer controls the autolocate of the selected tape machine. It is therefore very important that the correct machine number, determined by the Machine Page, is entered on the main Machine Setup page in the Maintenance Menu. Each time a different machine is selected the SSL Computer will immediately initialise itself for the new machine.

Note that with Q.Lock, Timeline and Motionworks devices, the system should always be in SYNC ON and the following applies to Adams Smith systems only.
SYNC OFF Mode

If you need to disable the synchroniser once it has been enabled, type:

SYNC OFF EX

and the system will now behave as if the synchroniser were not fitted. In SYNC OFF mode, machine control is limited to just one of the three possible masters A, B or C. The machine select buttons A to C on the synchroniser panel become mutually exclusive and the display panel does not report status information.

SYNC ON Mode

When the synchroniser is enabled the synchroniser page display on the screen will become active and display machine select status and current master status. The synchroniser display panel fitted in the console will immediately show all machines off-line or de-selected. When a machine is off line the display will report no statuses for that machine and so all the display leds will be off.

As soon as a machine is selected, with one of the machine enable buttons or from the keyboard, it will play for about a second. This is to ensure that the master reader in the Adams Smith has the correct code. The system will always default to the A machine being the system master. Therefore, selecting any further machines will cause them to enter the 'chase' mode and then they will attempt to locate and lock to the master. However, if you deselect the machine you first selected and select another machine, then this machine will enter play for one second. This is because the system will always take the highest selected machine to be the master. Only A,B and C machines can be system masters.

Using the Synchroniser

Before the synchroniser can be used for the first time, it is necessary to specify the machines to be controlled and other factors affecting synchroniser operation. This is achieved with the Setup Menu.

The Setup Menu

The Setup Menu pages relevant to the synchroniser system are summarised overleaf.

Menu | Title | Description
--- | --- | ---
Engineer | Session Page | defines timecode standard
Engineer | Sync Page | sets up the synchroniser options
Maintenance | Tape Machines | specifies tape transport control options
Maintenance | Machine Setup | specifies current machines for synchroniser control
Maintenance | Synchroniser Interface | specifies synchroniser controller

To enter the Setup pages, type: **SETUP EX**

For the Engineer Menu, enter 'Y' at the **do you want to see more?** prompt. If you want the Maintenance Menu, enter 'M'. Select the required page from the relevant menu.

Most of the Setup pages will have been correctly set on installation, and need not be altered from day to day. The fields, and instructions on how to enter information in the various pages of the Engineer Menu are given in Appendix I. The two pages which you may have to change occasionally are the Machine Setup and Synchroniser Page. Figure 1 shows the Machine Setup page which is accessed via the Maintenance Menu.

**Machine setup page**

<table>
<thead>
<tr>
<th>Machine Name</th>
<th>Menu No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>BUV 800</td>
<td>8</td>
</tr>
<tr>
<td>A 800</td>
<td>13</td>
</tr>
<tr>
<td>A DUDE</td>
<td>7</td>
</tr>
<tr>
<td>STUDER A810</td>
<td>12</td>
</tr>
<tr>
<td>MTR 12</td>
<td>6</td>
</tr>
</tbody>
</table>

Reel timecodes from machine A
Type SETUP to assign timecodes from machine to reel
Type END to finish

**Figure 1**

7-6
The 'Machine Name' column allows you to enter the appropriate machine name, this may be a conventional machine name or any other name you fancy. The 'Menu No.' column must have the number that corresponds to the number assigned to that specific transport in the Tape Machine page. Failing to do this may result in some very bizarre behaviour of the machine during an autolocate. The G Series Computer Service Manual and G Series Retrofit instructions cover all aspects of setting up machine parameters in the Setup Menu pages.

N.B the number of machines set up in this menu MUST match and not exceed the number of modules fitted to the synchroniser. (Adams Smith only)

The Synchroniser Option Page

- Synchroniser in use
- Resolve master machine
- Slow lock mode
- Group locates

<table>
<thead>
<tr>
<th></th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Synchroniser in use</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Resolve master machine</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Slow lock mode</td>
<td></td>
<td>NO</td>
</tr>
<tr>
<td>Group locates</td>
<td></td>
<td>YES</td>
</tr>
</tbody>
</table>

Figure 2

The sync page shown in Figure 2 displays four options available for the synchroniser system. They are as follows:

Synchroniser in use: determines whether SYNC ON is selected automatically on program load or restart.

Resolve master machine: enables the master to resolve (synchronise) to an external stable reference tone or video sync signal.

Slow Lock Mode: prevents audible frequency shifts when the system slaves correct themselves for bad timecode/sync errors.

Grouped locates: enable the machines to locate to the appropriate target directly rather than chasing the master after any given locate command.

It should be noted that these options may not apply to all systems.
The Synchroniser Status Panel

Figure 3 shows the panel, fitted to the console, which provides visual feedback of each machine's status (note that the Motionworker panel is slightly different in appearance and function). In addition, the top row of pushbuttons selects or de-selects machine control, the bottom row is used to enable or disable the 'Record Enable' facility for each machine. Do not be tempted to enable machine control until you have established proper mark points as described below.

![Panel Diagram]

The status display for each of the five machines is as follows:

- **RECORD** flashes when Record Enable is selected and is illuminated when actually recording.
- **PHASE** lights when a machine has a lock error of greater than 2/100 of a frame.
- **CODE** indicates that the machine has no timecode.
LOCATE indicates that the machine is locating.

PARKED indicates that the machine is parked or stopped.

Enabling The Synchroniser

If the SSL Synchroniser System is fitted, it is most likely that the 'synchroniser in use' option in the Sync Page of the Engineer Menu will be set to YES, and the system will automatically select SYNC ON on loading the program disc. If not, the synchroniser can be enabled by typing:

SYNC ON EX

The Synchroniser Status Page

This Sync Page provides a summary of the positions, marks and offsets of each machine, and enables the operator to monitor the status of each one. To display the Sync Page, type:

LIST SYNC EX

```
\begin{figure}[h]
\centering
\begin{tabular}{|c|c|c|c|}
\hline
Transport & Position & Mark \\
\hline
A & BUU 800 & 10:12:05.23 & 10:12:05.23 \\
B & A 800 & 10:12:06.08 & 10:12:06.08 \\
C & A DUDE & 10:12:06.10 & 10:12:06.10 \\
E & MTR 12 & 8:17.09 & 8:17.09 \\
\hline
\end{tabular}
\caption{Figure 4}
\end{figure}
```
The number of machines displayed depends on how many have been set up in the Machine Setup page. The 'M' in the first column denotes the master machine, and the name of each machine (as specified in the Machine Setup page) is displayed. As each machine is selected, the corresponding letter for that machine appears in the second column. If the machine has successfully locked to the master then a small 'blot' appears in the first column to indicate this.

Before selecting the machines you want to control, it is essential that you allow the system to read the timecode position of each one, because without any marks or offsets set, the slaves will try to chase the master as soon as they are selected and this could result in a slave machine spooling off its tape in an attempt to reach the timecode value of the master.

The Position column displays the timecode position of each tape as soon as it is read. This information is retrieved from the timecode reader for each machine in the synchroniser, whereas the numeric display at the bottom of the screen is the master timecode read by the SSL Computer.

So before you continue ......

Load the machines with tape, suitably striped with good timecode of the same standard. Select each available machine in turn and play it for a couple of seconds. Check that the SSL reader is reading the same code as the synchroniser reader for that particular machine. To monitor this, the large timecode display at the bottom of the screen (SSL reader) should match the timecode of the respective machine you have selected.

If the tapes are to be used for the first time, select each in turn again and locate them to a suitable point at which to begin the recording. Or if using tapes containing recorded material, locate each one to approximately the same point in the recording.

Designating the Master

The three machines A, B and C can each become the master machine which is controlled directly from the console. The other machines are known as slaves, and chase the master. The master machine is determined by a priority system and it can either be specified by the operator, or if not, the master will always default to machine A. If machine A is not selected, B becomes the master, and so on. To designate B as the master, type:

BM EX
The timecode track of the master machine is read by the synchroniser and relayed to the main Studio Computer for use by the tape location and Mix system etc. The timecode of the slave machines is also used by the main computer on the SYNC page, but is not stored directly on a REEL.

Setting the Marks

Before selecting the machines and initiating chase synchronisation, the reference points, at which all machines are synchronised, should be entered. These reference points are known as 'mark' points and represent a position on each tape that corresponds to the same point in the recording. The offsets for each machine are automatically calculated by the system. If you have located machines A, B and C to a suitable starting point, enter:

**ABC HERE EX**

Or each machine can be individually cued, and the mark point set by typing:

Machine **HERE EX** where Machine is A, B, C etc

<table>
<thead>
<tr>
<th>Transport</th>
<th>Position</th>
<th>Mark</th>
</tr>
</thead>
<tbody>
<tr>
<td>BVU 800</td>
<td>10:12:05.23</td>
<td>10:12:05.23</td>
</tr>
<tr>
<td>A 800</td>
<td>10:12:06.08</td>
<td>10:12:06.08</td>
</tr>
<tr>
<td>MTR 90</td>
<td>10:12:06.10</td>
<td>10:12:06.10</td>
</tr>
<tr>
<td>MTR 12</td>
<td>8:17.09</td>
<td>8:17.09</td>
</tr>
</tbody>
</table>

**10:12:05.23**

Figure 5
The Mark positions will be entered on the Sync Page and in Figure 5 these values are shown in the furthest right hand column. They will be the same values as displayed in the current position column.

Mark points can also be entered as timecode values, using the command line:

```
Machine AT TIME EX
```

e.g. B AT 3:40:28.6 or 03402806 EX

Mark times can also be specified using the marks already set up for one of the machines:

```
A AT B EX    sets the mark for machine A to that of B.
```

Selecting Machines

To select the machines you want to use, press the required keys A to E on the top row of the status panel. As the machines are selected, the slaves will chase the master, but provided suitable mark points have been entered, they will park together and from now on can be controlled as one.

Machine selection can also be toggled from the keyboard with the SETUP command, e.g.

```
A SETUP EX    (toggles machine A selection)
```
or

```
ABC SETUP EX    (toggles machines A, B and C)
```

Once the machines you require are selected, they should locate and park with respect to the master's current position. The accuracy of the slave's parking is determined by various constants that are set up within the synchroniser. Constants vary from machine to machine and determine their behaviour in the chase mode and also their 'time to sync' speed. Constants are discussed later on in this section.
Autolocation (Adams Smith Systems)

When the master is located in SYNC ON, the 'target address' is sent to the Z8 from the Studio Computer. The Z8 then passes this target point on to the Adams Smith serial interface which in turn directs it at the currently assigned master machine. The master's tach output is fed to the master LTC reader and so the slaves follow or chase the master. With the G Series System, the master tach is fed to the reader from the master machine. The tach rate i.e. pulses per second, is downloaded from the Studio Computer via the Z8 to the LTC reader. This therefore improves the accuracy of the slaves 'chase-lock' performance.

Group Locates

Group locates change the way in which the slaves locate when any autolocate command is sent from the Studio Computer. Instead of chasing the master, that is chasing the master LTC reader, each slave is sent an individual target point. This target point is irrespective of their current offset. This option is very useful if your system has a slow master and a fast cueing slave. However, the philosophy of the Adams Smith system is that if a slave parks behind the master, the moment the slave(s) are given a chase command they will re-park. Ideally the best way to make this function work is to set the master's constants so that it will park before the specified target point.

Off-line Locates

Individual machines can be located off-line. Any machine, except the master, can be sent a target address and regardless of whether it is currently on or off-line, it will locate to that target.

\[
\text{C GOTO TIME EX} \quad \text{locates the C machine to the target TIME regardless of its current offset}
\]

The 'Time to Sync' Page

When the Sync Page is displayed, the ↑↓ keys can be used to toggle between the Tape Position information and the page displaying the 'time to sync' (see Figure 6) of each machine. As the slaves lock to the master, the time to sync counts down to zero and is replaced by a solid bar to show that lock is achieved. If the master is locked to an external source (resolved to video) a bar appears next to the master when it is resolved.
Using Offsets

Users of the SSL Synchroniser System need never use offsets, as they are calculated from the mark points by the system. However, in post production work, tapes are often supplied with offsets specified. An offset is the timecode difference (positive or negative) between two tapes when they are synchronised to the same point in the programme material.

To display the offset page, type:

LIST SYNC EX

Use the → ↑ keys to select the offset page (Figure 7).
To enter offset values, the command line is the same as that used for entry of mark positions i.e.

Machine AT TIME EX (when the offset page is displayed)

The command line:

B AT C EX sets the offset for machine B to that already defined for C

**Sub-Frame Offsets**

The G Series Synchroniser System offers the facility to adjust offsets from the keyboard within a sub-frame. The Adams Smith offset system is based on 100ths of a frame. Therefore offsets can be set approximately to frame level and then trimmed to sub-frame level. Sub-frame offsets are entered in the following manner:

B* n EX (where n is a value between 00 and 99)
Since sub-frame offsets cannot be displayed within the SYNC display box, it may be necessary to check the current sub-frame offset for a particular machine. To do this, type:

\[ C^*? \text{EX} \] note the position of the ?

The computer will then reply with the full offset for that machine. To increment or decrement the sub-frame offset value for a particular machine, type:

\[ B^* + (n) \text{EX} \quad \text{or} \quad B^* - (n) \text{EX} \quad \text{or} \quad B^* + \text{EX} \]

**Modifying Marks and Offsets** (to frame accuracy)

Marks and offsets can be adjusted on-line in order to achieve synchronisation of recorded material between machines. Add to or subtract from the times shown in the marks or offsets column by using the command line:

\[ \text{Machine + or - time EX} \]

If a time is not specified, a one frame nudge occurs. The REPEAT key can be used to repeat the command until the recorded material synchronises.

**Sync Presets**

Marks and offsets can be stored on the REEL as 'Sync Presets' so that they can be recalled at a later date. Each TITLE has its own list of Sync Presets and to save the marks and offsets the command line is:

\[ \text{NAME SYNC PRESET (Name) EX} \]

To list the available presets within that TITLE, type:

\[ \text{LIST SYNC PRESET EX} \]

To store new mark points, ie for an existing Sync Preset, type:

\[ \text{REVISE SYNC PRESET Name EX} \]

To load mark points from a Sync Preset and send the offsets to the synchroniser, type:

\[ \text{SYNC PRESET Name EX} \]
To load and simultaneously locate the machines to their mark points, type:

GOTO SYNC PRESET Name EX

To load and simultaneously locate and play the machines from their mark points, type:

PLAY SYNC PRESET Name EX

To delete a particular Sync Preset from the current REEL, type:

DELETE SYNC PRESET Name EX

Sync Presets can be copied from one REEL/TITLE to another in the same way as CUES. This is achieved by using Copy command lines as described in Section 4.

The PRINT key can be used to print out the names and timecodes of the sync presets for the current TITLE. If 'screendumps' are not enabled in the Printer Menu then type:

PRINT SYNC PRESET EX

N.B Sync Presets are stored on the current REEL with all the machines' Marks and Offsets. Sub-frame offsets are NOT stored as part of the offset information on the REEL.

Recording

With SYNC ON, Record Enable status must be selected for each machine before it can be put into record. The bottom row of buttons on the synchroniser status panel are used to select Record Enable status which is shown by the flashing RECORD indicator under each machine select button. Pressing RECORD and PLAY on the remote transport keys, will place only the enabled machines into record. Machines will NOT enter the Record state until they are locked. The master machine will always enter record immediately because it's always locked! However, if the master is 'resolving' then it also must be in lock before it can be put into record. The associated RECORD indicators light continuously when a machine is in record.
Record Enable status can also be toggled from the keyboard with the command line:

A DROP-IN EX (toggles status for machine A)
or
ABC DROP-IN EX (toggles A, B and C)

Drop-ins can be played in the usual way, but when using the synchroniser, Record Enable status must be selected in addition to pressing the master RECORD ENABLE key on the console keyboard.

The drop-in time can be set at the master mark point of the Sync Preset by typing:

DROP-IN AT SYNC PRESET (Name) EX

Using a Master Group

A master group may be defined to enable two or more machines to be treated as one. This makes marking and offset operations much easier in a situation where the master video machine and multitrack machine have the same timecodes. The facility is used when two or more machines must lock with the same offset/mark point even though the offset may have to be adjusted to synchronise with machines outside the group. Once a master group has been set up, the sync page only displays mark and offset values for the first machine in the group.

To setup a master group the SYNC command is used, e.g.

SYNC AB EX places machines A and B in a master group.

The master group information is stored on the Reel associated with that Title. To break up the group, type the (award-winning prize for obscurity) command:

AB? EX
Specifying the Reference Timecode Machine

Although the reference timecode used by the Studio Computer is always read from the master machine, the timecode references to be recorded on the REEL can be related to timecode from another machine in the master group so that, if at a later date the master tape is not available, the cues, and other references on the REEL can be used with the other tape. The reference machine timecode is specified as follows.

Type SETUP EX to access the Setup Menu followed by 'M' to access the Maintenance pages. Press the SYNC key followed by the SETUP key to select the Machine Setup page. Place the cursor next to the required machine and press SETUP.

The machine you want the REEL timecode to be referenced to must be part of a machine group. That is to say, even if you have the machine reference set to B, you must then make B part of a group in order to use its timecode as the REEL reference. ie SYNC AB EX.

Selecting the Timecode Standard

With SYNC ON, the timecode standard, which can be 24 frame FILM, 25 frame EBU, 30 frame SMPTE or 29.97 Dropframe, is selected via the front panel controls of the LTC Generator on the Adams Smith synchroniser.

With SYNC OFF, timecode is generated and read by the Studio Computer, and the standard is selected on the Session page of the Setup Menu.

If you are unsure of which standard you should be working with, refer to Appendix II.

Generating Timecode and Striping the Tape

With SYNC ON, timecode is generated by the synchroniser (and not by the Studio Computer as in SYNC OFF). The instructions for timecode generation are displayed by typing:

EBU or STRIPE or SMPTE EX
Either the synchroniser or the Studio Computer may be used to generate
timecode, but if the Studio Computer is used it cannot be used for anything else
until you press CANCEL to stop the timecode generator.

By entering a timecode value, the generator can be pre-loaded with a time from
which it will start.

The JOIN key can be used to lock the timecode generator to an external
timecode source which is fed into the master LTC timecode reader (jam
sandwich mode).

If neither of the above options is selected then the generator will start from zero.

Resolving the Master Machine

The master machine can be locked to a stable external signal such as a video
sync pulse or a pilot tone. This signal is fed into the VID or EXT input of the
synchroniser and the timecode generator is switched to VID or EXT as
appropriate.

To enable resolve mode, type SETUP EX and then press SYNC to select the
Sync Menu page. Move the cursor and enter 'Y' in the 'Resolve master machine'
line

Note that only the assigned master can be resolved. Thus, if master machine A
is deselected and the system shows B as the master, it can't be resolved until it is
assigned as the current system master. This is done by typing:

  BM EX

or

  CM EX

Constants

Constants are set within each synchroniser module to enhance the performance
of the machines locate and lock-up times. These constants are usually set by the
SSL commissioning engineer or an engineer from your maintenance department.
With the Adams Smith system there are currently 45 constants to set per
machine within each synchroniser module. However, don't be put off by this
since most of those constants refer to 'options' that need not be worried about
when using the SSL Synchroniser System.
The Synchroniser in Mix

When using the mix system, the only synchroniser commands available are the offset commands. Machines can still be taken on and off-line, but it is not possible to change masters. If you have bargraphs enabled then the LARGE/SMALL key will toggle between the Synchroniser Page and the bargraph display.

DIB