

Contents

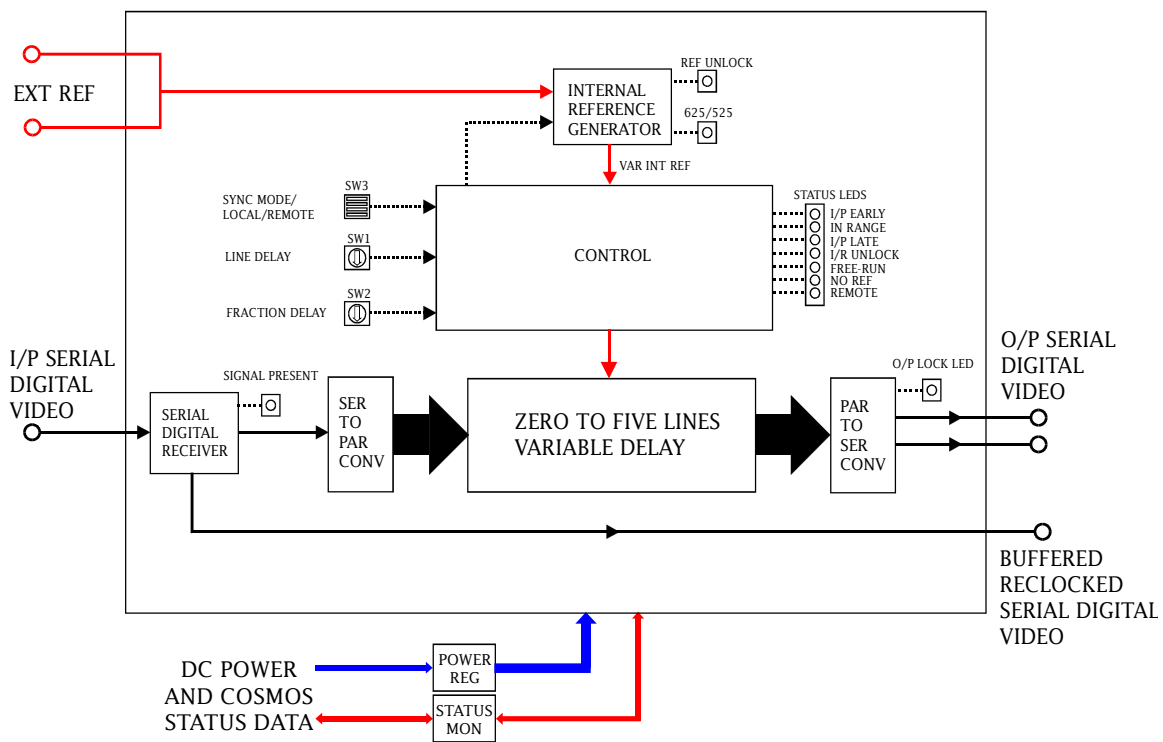
1 Introduction	2
2 Installation	4
2.1 Rear panel connections	4
3 Configuration	6
3.1 Setting the correction window	7
3.2 Setting the black line insertion mode	9
3.3 Setting the local/remote control mode	10
4 Trouble shooting	12
4.1 Ensuring basic operation	12
4.2 Validating the video reference	13
4.3 Ensuring correct timing	13
5 COSMOS status monitoring	14
6 Specification	16
7 Ordering Information	19

1 Introduction

The ICON 3401 is a serial component digital video synchroniser with a five line correction window. It can be used singly or in cascade with similar units.

The 3401 has the following features:

- five line correction window
- transparent re-framing of upstream switching for 'in-range' signals
- two main serial digital video outputs
- buffered and re-clocked serial digital video input loop through
- automatic input equalizer
- analogue reference loop through
- +/- 5 line genlock range with respect to analogue reference
- automatic TV standard selection
- compatible with Pro-Bel COSMOS status monitoring

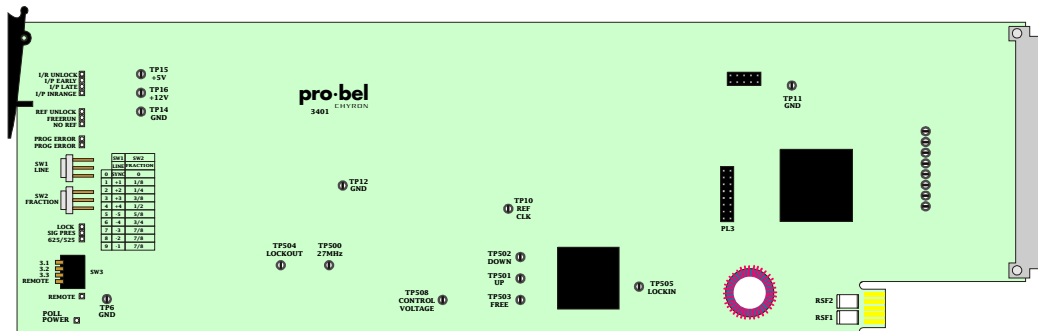


3401 five line synchroniser



2 Installation

The line synchroniser consists of a 3401 ICON module which takes a single card position in either a 1U 1051 or a 3U 1050 modular rackframe. It uses the 30mm K3401.3 rear connector. For module installation instructions please refer to the appropriate ICON rack frame section of the manual.



The 3401 ICON line synchroniser

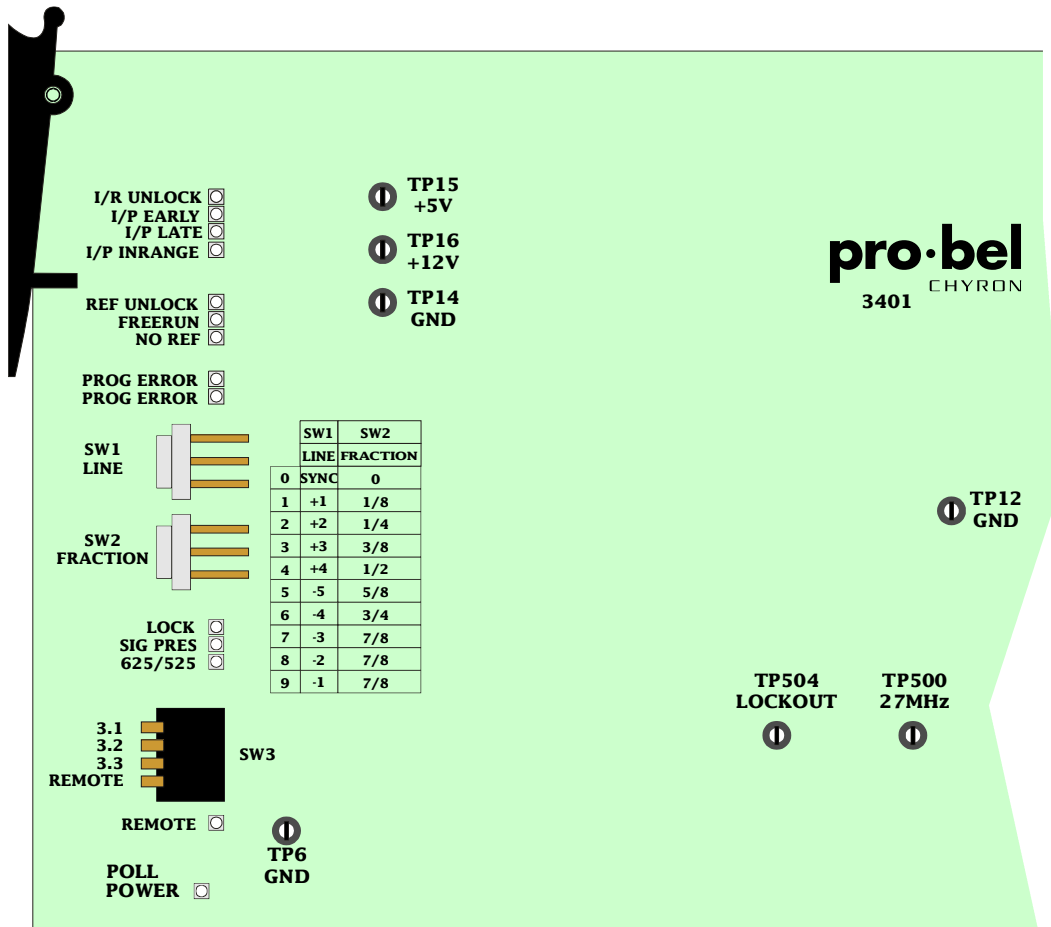
2.1 Rear panel connections



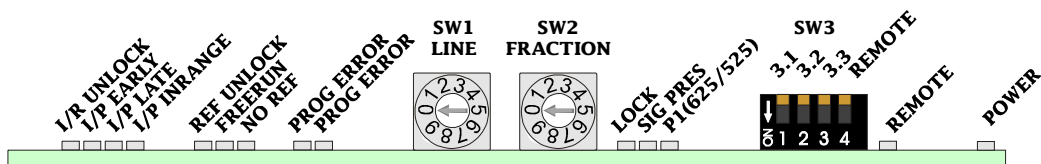
The K3401.3 rear panel has four BNC connections for signal I/O; one serial digital video input, a buffered and re-clocked loop through output and two main outputs. In addition there are two BNC connections for the analogue reference loop through.



3 Configuration



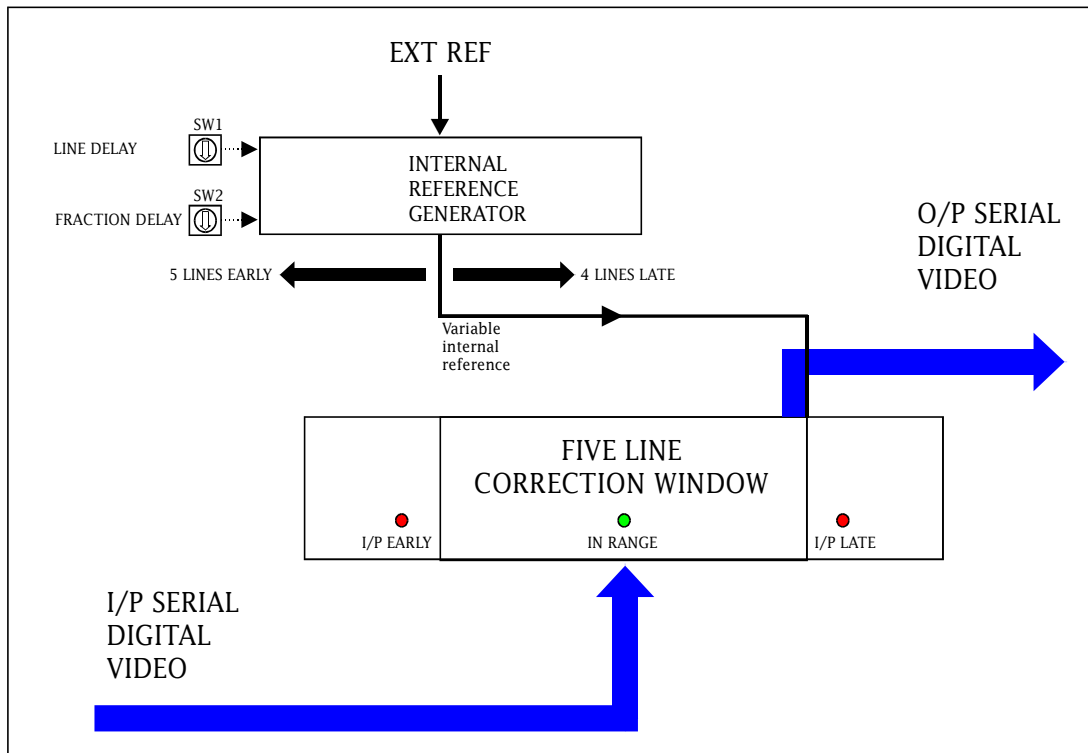
Sectional view showing configuration controls



Front view with handle removed for clarity

3.1 Setting the correction window

For the input video to be synchronised, it must lie inside the five line correction window. This is achieved by delaying or advancing the internal reference with respect to the external reference, with the line delay and fractional delay controls, until the in-range LED is illuminated.



The line synchroniser correction window may be thought of as a variable delay of zero to five TV lines, through which the input SDI passes. Once the input is centred within the correction window by altering the internal reference timing, the amount of delay is automatically adjusted to give constant output timing. This will hold true despite changes in input timing, providing those changes remain within the correction window range. Larger changes in input timing can only be accommodated by re-adjusting the internal reference timing to bring the input back inside the correction window. This is achieved by adjusting SW1 and SW2 until the green 'in range' LED is illuminated.

Note: The early settings accommodate an input earlier than the reference and should not be taken to imply that the synchroniser can advance the input

Adjust the internal reference to centre the input within the correction window using SW1 for whole line delay and SW2 for adding delay in steps of 1/8th of a line.

Whole line delay		Fractional delay	
Output timing	Switch SW1 position	Output timing	Switch SW2 position
-5 lines early	5	Exact line delay value	0
-4 lines early	6	Line delay + 1/8	1
-3 lines early	7	Line delay + 1/4	2
-2 lines early	8	Line delay + 3/8	3
-1 line early	9	Line delay + 1/2	4
In sync	0	Line delay + 5/8	5
+1 line late	1	Line delay + 3/4	6
+2 lines late	2	Line delay + 7/8	7
+3 lines late	3	Line delay + 7/8	8
+4 lines late	4	Line delay + 7/8	9

The synchroniser will work with switched inputs without readjusting the internal reference providing timing variations between the inputs are less than five lines.

To optimise the synchroniser to work with a number of differently timed inputs, proceed as follows:

- connect the latest digital video input signal to the synchroniser
- move the internal reference with **SW1** (line) so that the green 'in range' LED illuminates
- rotate **SW1** so that the red 'I/P late' LED just comes on and back it off one step to bring it back into range
- continue moving the internal reference in 1/8th of a line steps using **SW2** (fraction) until the 'I/P late' LED comes on and back it off one step to bring it back into range

The correction window will now cover any input up to five lines (4 7/8 lines) earlier than the latest signal.

3.2 Setting the black line insertion mode

There are three modes of operation of the line synchroniser designed to optimise performance when input signals are switched or other sudden timing changes occur. The three modes affect the lines around the vertical interval which are replaced by an internally generated digital black. This is done to optimise performance taking into consideration the presence of embedded audio and the degree of input mid-timing present. The insertion modes are selected by SW3 as follows:

Transient black line insertion modes			
SW3 1=ON, 0=OFF	Mode	Lines of black insertion	Application
SW3-1 OFF	Single line	Digital black replaces the line containing the SMPTE RP168 switch point	Correctly timed inputs with embedded audio
SW3-1 ON SW3-2 OFF	Multiple line (ML1)	Digital black replaces active picture area for seven lines around switch point	Mis-timed inputs with embedded audio
SW3-1 ON SW3-2 ON	Multiple line (ML2)	Digital black replaces active picture and horizontal blanking for seven lines around switch point	Mis-timed inputs without embedded audio



Single line mode

The single line mode is designed for relatively precisely timed input signals carrying embedded audio. In this mode only the active line period containing the switching point recommended by SMPTE RP168 is replaced by digital black. For entirely 'click free' switching the line synchroniser will only deal with timing variations of up to plus or minus half a TV line. Greater errors may result in dropped or repeated audio samples.

Multiple line modes

In multiple line modes a group of seven lines around the switch point are replaced with black. These modes should be used when imprecise upstream switching is to be corrected. There are two multiple line modes, ML1 is designed for imprecisely timed inputs with embedded audio whilst ML2 caters for mis-timed inputs without embedded audio. The second multiple line mode replaces horizontal blanking in addition to the active line period. This would not work with embedded audio since the audio data would be replaced by the extended black insertion.


The following chart details the actual lines affected by black line insertion in each mode:

Insertion lines		
Insertion mode	inserted lines, 525	Inserted lines, 625
Single line, 1-5 lines delay	10 and 273	6 and 319
Multiple line, 1 line delay	9-15 and 272-278	5-11 and 318-324
Multiple line, 2 line delay	8-14 and 271-277	4-10 and 317-323
Multiple line, 3 line delay	7-13 and 270-276	3-9 and 316-322
Multiple line, 4 line delay	6-12 and 269-275	2-8 and 315-321
Multiple line, 5 line delay	5-11 and 268-274	1-7 and 314-320

3.3 Setting the local/remote control mode

The control of the whole line and fraction delay settings can be transferred to the COSMOS status monitoring system with SW3-4.

Assigning delay control		
SW3 lever 4	Control mode	Notes
OFF	Local	Use SW1 and 2
ON	Remote	Local control disabled



The yellow remote LED will illuminate when the remote mode is selected.

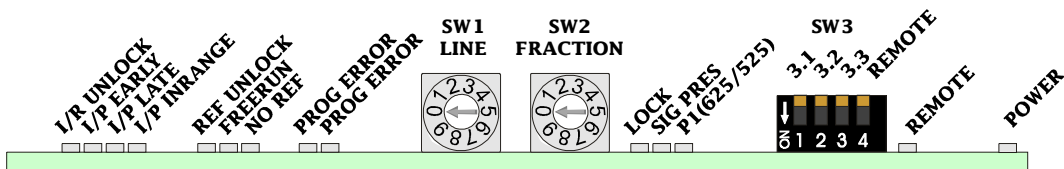
Note that SW3-3 is not assigned.



4 Trouble shooting

4.1 Ensuring basic operation

The LED indicators on the board use a simple colour coding to assist with easy status monitoring. Green is used for LEDs that usually remain on and indicate correct operation, yellow is used to provide information such as mode or selected line/frame rate standard, and red indicates an error condition. Many of these status indicators are also made available to the Pro-Bel status monitoring system and may be monitored remotely and logged.



Basic indicators			
LED	Indication	Status Monitored	Meaning
Power	Green	Yes	Both +5 volt and +12 volt on-board regulators working
Prog Error	Red	No	Control circuit programming fault
Lock	Red	No	Lights to show an INVALID serial digital output
Signal Present	Red	Yes	Lights when an input signal is NOT present. The output will cut to black with no input connected.
P1 (625/525)	Yellow	Yes	TV standard, OFF=625
Remote	Yellow	Yes	OFF=LOCAL

4.2 Validating the video reference

The following table shows what indications are to be expected under varying conditions of the reference signal.

Reference indicators			
LED	Indication	Status Monitored	Meaning
No ref	Red	Yes	No analogue reference signal present. The synchroniser will output uncorrected input video with no reference.
Ref unlock	Red	Yes	Internal reference running at a different frequency to the reference signal
I/R unlock	Red	Yes	Internal reference running at a different frequency to the input signal
Free run (+No ref)	Red	Yes	No reference signal present, internal reference being used
Free run (+I/R unlock)	Red	Yes	Reference signal running at a different frequency to the input signal, internal reference being used

4.3 Ensuring correct timing

When the only green LED, called 'in range', is on then a valid input signal is within the correction range of the synchroniser. In this case the output will be synchronised to the incoming video reference. Any other combination of LEDs indicate that something is wrong. The I/P early and I/P late indicators show that the input signal is outside the correctable window in the direction indicated.

Range indicators			
LED	Indication	Status Monitored	Meaning
I/P Early	Red	Yes	I/P early with respect to correction window
I/P Late	Red	Yes	I/P late with respect to correction window
I/P In range	Green	Yes	I/P within correction window - normal operation

5 **COSMOS status monitoring**

The 3401 module will provide the following information to the COSMOS status monitoring controller (if fitted):

- module present
- power OK
- signal present
- no reference
- I/R unlock (internal reference unlocked)
- reference unlock
- freerun
- I/P in range
- I/P early
- I/P late
- line and fraction delay setting
- 525/625 standard
- remote/local mode

The following module parameters may be controlled through the status monitoring system, when remote operation is enabled:

- whole line and fraction delay settings

Remote operation is indicated by illumination of the yellow remote LED.

In addition, the module is programmed with the following information, which can be read by the status monitoring controller:

- Module type
- Module bar code
- Module issue no

For further details of the Pro-Bel status monitoring system please refer to the COSMOS status monitoring manual.



6 Specification

Video inputs

Number	One
Type	Serial, EBU Tech 3267E, SMPTE 259M - C
Impedance	75Ω
Connector type	BNC
Data rate	270MBit/s
Regenerator	Clock regeneration on input
Return loss	>15dB 10MHz to 300MHz; >13dB 300MHz to 400MHz
Amplitude	800mV p-p nominal
DC offset	<50V
Equaliser	Adaptive automatic for up to 200m of cable (Belden 8281, PSF 1/2M or equivalent)

Video outputs

Number	Three
Type	Unbalanced NRZI coded serial data
Specification	Two outputs to SMPTE 272M - A. One output to EBU Tech 3267E, SMPTE 259M - C (regenerated copy of input)
Impedance	75Ω
Connector type	BNC
Data rate	270MBit/s
Return loss	>15dB 10MHz to 300MHz; >13dB 300MHz to 400MHz
Amplitude	800mV p-p nominal
Overshoot	< 7%
DC offset	0V ±0.5V

Performance

Correction range	Five television lines
Genlock range wrt to external video reference	Five lines early to 4 7/8 lines late
Television standard	Automatic (525/625)
Equaliser	Automatic



7 **Ordering Information**

ICO-3401-3000

SDI Line Synchroniser with 30mm rear panel