DB11

Video Character Overlay module

User Manual

Revision 0.1
9th October 2023

Revisions

Date	Revisions	Version
09-10-2023	First draft	0.1

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1. Introduction

DB11 is a character/text overlay module for digital video sources. DB11 is ideal for inserting text, channel IDs, menus, status and titles on video sources.

DB11 accepts serial digital inputs (SDI, HD-SDI or 3G-SDI), which it can overlay with text, before outputting as a re-clocked serial digital output. DB11 auto-detects the input standard and supports 525i, 625i, 720p-25/30/50/59.94/60Hz; 1080p-24/25/29.97/30/50/59.94/60Hz and 1080i-50/59.94/60Hz standards. Text is written via an RS232 interface.

DB11 offers 112 pre-programmed characters: each character is 12x16 pixels but a x2 (24x32 pixels) and x4 (48x64 pixels) magnify function is available. The colour of the character and the background is programmable.

DB11 requires 12VDC which is provided via the supplied AC-DC converter.

2. Quick start guide

Connect the DB11 to the supplied AC/DC adaptor. Fit the appropriate blades to the adaptor for your country. Blades are supplied for North America, Europe, UK, China and Australia. The adaptor accepts AC between 90 and 264VAC – the full specification is provided in Appendix A.

The connections to the DB11 are shown in Figure 1.

Connect the 12VDC jack from the adaptor to the +12VDC 'Power in' socket on the DB11. The 'Power On' LED should light up blue.

Figure 1 DB11 Connections.

Connect a valid serial digital video source to the SDI input BNC socket: the SDI Lock should light.

Connect the SDI output to a monitor or other SDI compatible device - the SDI output is a reclocked copy of the input. By default, the input standard is automatically detected but the standard can be manually preset via the RS232 interface if required. The standards accepted are shown in Table 1.

RS232 Setting	Video standard	Character display	Comments
$00	720p25	106 x 45	
$01	720p30	106 x 45	
$02	720p50	106 x 45	
$03	720p59	106 x 45	
$04	720p60	106 x 45	
$05	1080p24	128 x 64	The 128 characters are limited by the DB11 memory. For 1080p standards 1920/12 = 160 characters could be displayed. The horizontal position command may be used to move the 128-character display as required.
$06	1080p25	128 x 64	
$07	1080p29	128 x 64	
$08	1080p30	128 x 64	
$09	1080i50	128 x 64	
$0A	1080i59	128 x 64	
$0B	1080i60	128 x 64	
$0C	1080p50	128 x 64	
$0D	1080p59	128 x 64	
$0E	1080p60	128 x 64	
$10	525i	60 x 30	
$11	625i	60 x 32	

Table 1 DB11 video standards.

If no valid SDI input is detected the output will not be valid.

The RS232 interface is used to write text to the display. The connections to the RS232 9 pin D-type connector are as follows:

Pin 2   RS232 output (from DB11 to PC).
Pin 3   RS232 input (to DB11 from PC).
Pin 5   Ground.
Pin 7   Connected to Pin 8.
Pin 8   Connected to Pin 7.
Pin 1,4,6,9   Not connected.

The RS232 interface is described in Chapter 4.

Figure 2 Example of the SM11 used to provide status information.

3. DB11 Technical Details

A simplified block diagram of the DB11 is shown in Figure 3.
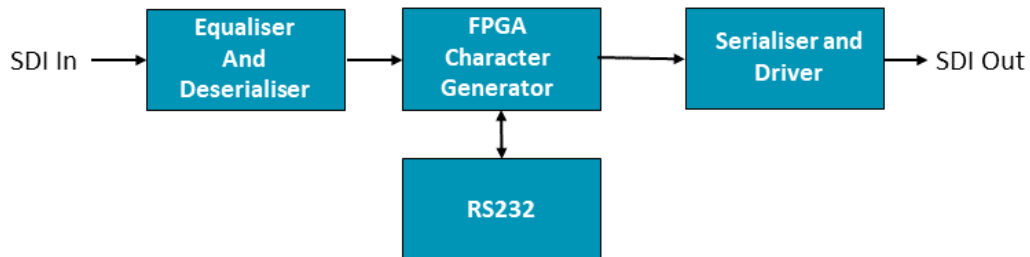
Figure 3 DB11 Block diagram.

The +12VDC from the AC/DC power adaptor is filtered and protected from over-range or reverse polarity inputs. The 12VDC input is then regulated to provide clean power supplies for the module.

The SDI input is equalized and de-serialised. An FPGA overlays the required characters on the SDI input video before outputting the video to an SDI serialiser and driver.

Each character is 12 pixels wide and 16 lines high, regardless of the video standard. There is an option to enlarge the character by a factor of 2 (24 x 32) or 4 (48 x 64). The enlarged character pixel replicates the original 12x16 character.

Figure 4 shows the character layout for 720p resolution. 720p has an active display of 1280 pixels x 720 lines. Therefore, we have 1280/12 = 106 characters (RS232 command $86 – value between $00 [$0_{10}$] and $69 [$105_{10}$]). Vertically we have 720/16 = 45 characters (RS232 command $87 – value between $00 [$0_{10}$] and $2C [$44_{10}$]).
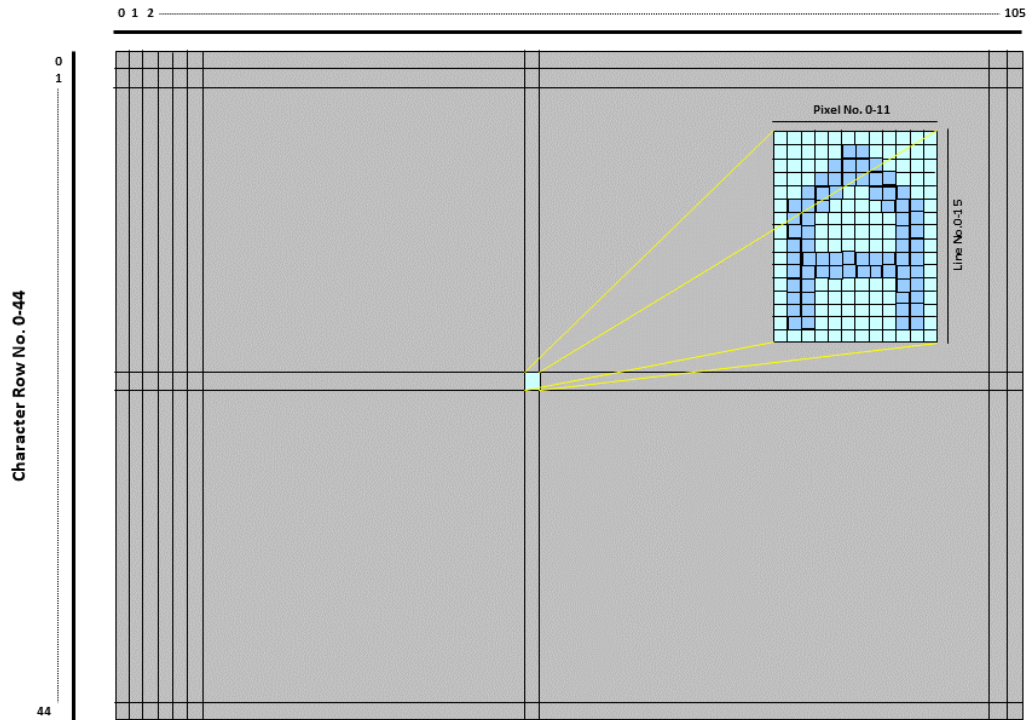
Figure 4 Character display format (720p).

If the Size of the character is set to x2 (24x32 pixels) the display will be 53 x 22 characters. Characters written outside of this range will be stored but not displayed.
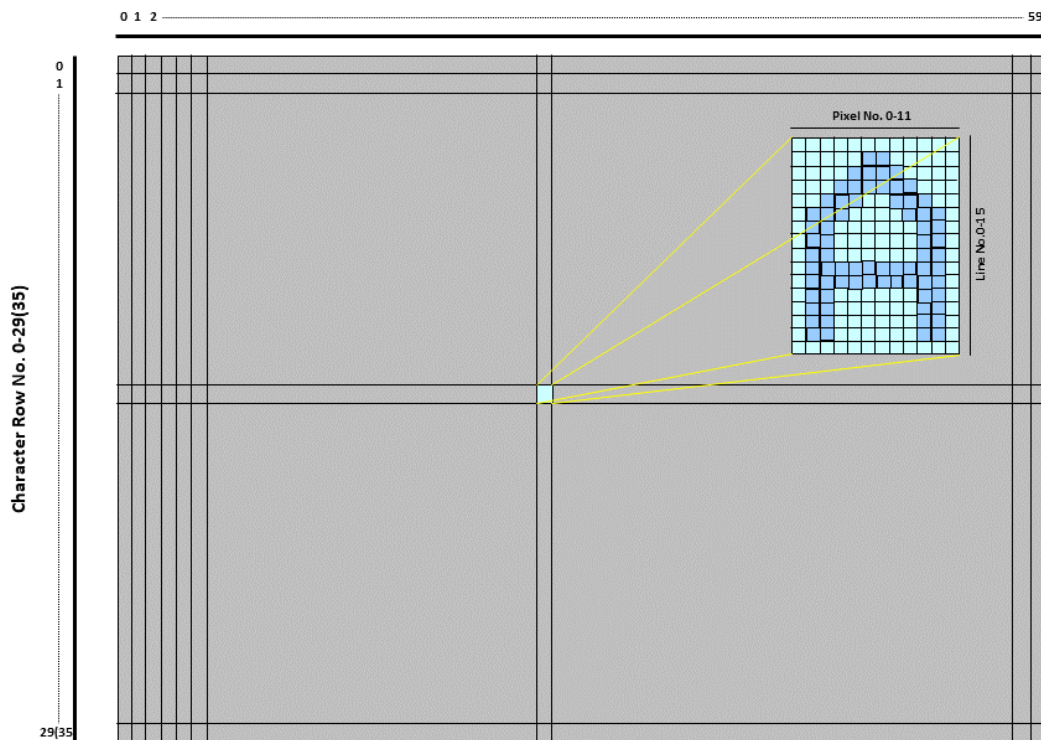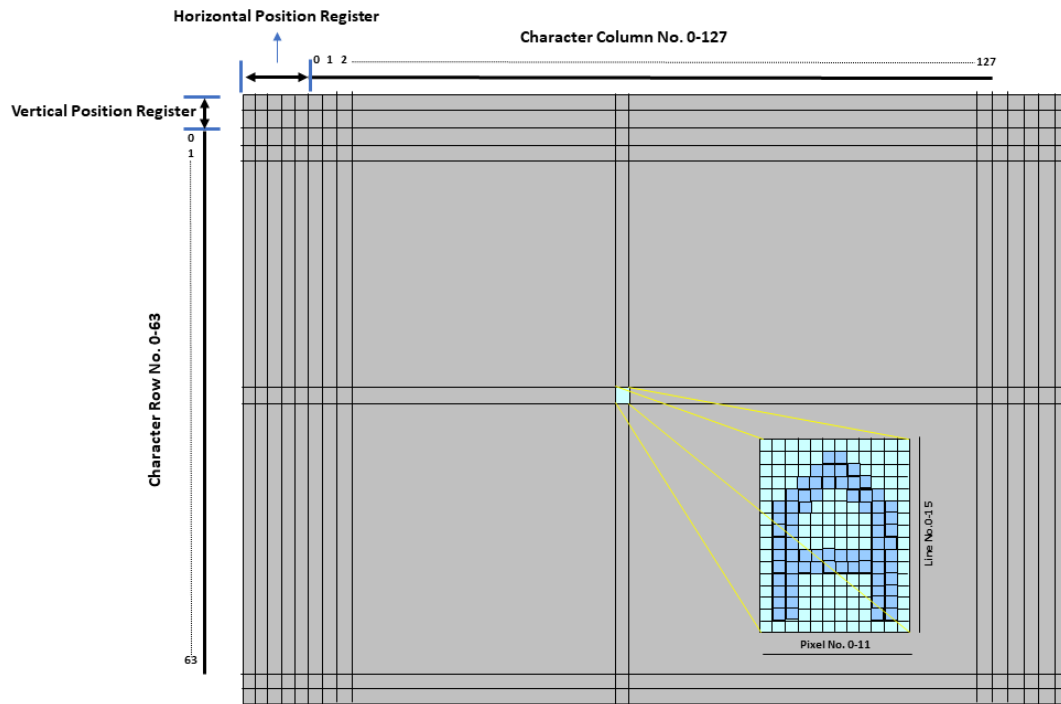

Figure 5 Character display format (525i and 625i).

If the Size of the character is set to x2 (24x32 pixels) the display will be 30 x 15 (525i) or 30 x 18 (625i) characters. Characters written outside of this range will be stored but not displayed.

Figure 6 Character display format (1080p).

4. RS232 control

The format of the RS232 interface is 8-bit data, 1 start, 1 stop bit and no parity. The communication speed is 9600 baud.

The command interface has the following structure:

Command word : Command data (optional) : Command data (optional) : Command termination ($FD).

The commands are shown in Table 1.

Command	Data	Command description	Comments
$80	NA.	Clear display.	Erases all the stored characters.
$81	NA.	Set auto standard.	Video standard is automatically determined.
$82	See Table 1.	Set manual standard.	Video standard is manually set. If the SDI input does not match this setting the output if forced to colour bars at the manually set standard.
$83	MSB, LSB	Horizontal position.	
$84	MSB, LSB	Vertical position.	
$85	Auto/manual	Address increment.	If the data is set to $00, the horizontal character address automatically increments when each character is written. If the data is set to $01, the horizontal character address does not increment and the existing character is overwritten.
$86	Address	Set horizontal character address.	Address value between 0_{10} and 127_{10}.
$87	Address	Set vertical character address.	Address value between 0_{10} and 63_{10}.
$88	Size	Character size.	If Size is set to $00 the character size is 12x16 pixels. If Size is set to $01 the character size is 24x32 pixels. If Size is set to $02 the character size is 48x64 pixels. The larger character sizes use pixel replication.
$90	Y Value	Sets the character Y value.	See Table 4.
$91	Cb Value	Sets the character Cb value.	See Table 4.
$92	Cr Value	Sets the character Cr value.	See Table 4.
$93	NA	Turns on colour background.	If set the background behind each character is turned on, else only the character is displayed.
$94	NA	Turns on video background.	If set the video 'behind' the character is dimmed and made monochrome, else only the character is displayed.
$95	Y Value	Sets the background Y value.	See Table 4.
$96	Cb Value	Sets the background Cb value.	See Table 4.
$97	Cr Value	Sets the background Cr value.	See Table 4.

Table 2 DB11 RS232 commands.

Example commands are:

$82, $04, $FD	-	Set manual standard to 720p/60Hz.
$83, $00, $64, $FD	-	Shift the character display right by 100 pixels.

The output of the character RAM selects one of 112 characters; the characters available are shown in Table 3.

To write a character it is only necessary to send the character value via the RS232 interface (no termination character). The character will be written at the address set by commands $86 and $87. If the address auto-increment is enabled the next character will be written at the next horizontal position. For example, to write 'SingMai' at the starting address previously set, the sequence $1D, $2D, $32, $2B, $17, $25, $2D would be sent.

Hex Code		Hex Code		Hex Code		Hex Code	
$00	[1]	$10	F	$20	U	$30	l
$01	0	$11	G	$21	W	$31	m
$02	1	$12	H	$22	X	$32	n
$03	2	$13	I	$23	Y	$33	o
$04	3	$14	J	$24	Z	$34	p
$05	4	$15	K	$25	a	$35	q
$06	5	$16	L	$26	b	$36	r
$07	6	$17	M	$27	c	$37	s
$08	7	$18	N	$28	d	$38	t
$09	8	$19	O	$29	e	$39	u
$0A	9	$1A	P	$2A	f	$3A	v
$0B	A	$1B	Q	$2B	g	$3B	w
$0C	B	$1C	R	$2C	h	$3C	x
$0D	C	$1D	S	$2D	i	$3D	y
$0E	D	$1E	T	$2E	j	$3E	z
$0F	E	$1F	U	$2F	k	$3F[Note 2]	
$40	:	$50	←	$60	—		
$41	-	$51	(	$61			
$42	/	$52	)	$62			
$43	.	$53	#	$63			

Hex Code		Hex Code		Hex Code		Hex Code	
$44		$54		$64			
$45		$55		$65			
$46		$56		$66			
$47		$57		$67			
$48		$58		$68			
$49		$59		$69			
$4A		$5A		$6A			
$4B		$5B		$6B			
$4C		$5C		$6C			
$4D		$5D		$6D			
$4E		$5E		$6E			
$4F		$5F		$6F			
Note 1	Value '0' displays nothing. All other values automatically turn on the background if it is enabled.						
Note 2	Value '$3F' is a space. i.e. it displays background only, (if enabled), but no character.						

Table 3 Pre-programmed Characters

The colour of each character and the background is programmable. Example values are shown in Table 4.

Colour	Y value	Cb value	Cr value	
White	235	128	128	
Grey	180	128	128	
Yellow	161	44	142	
Cyan	131	156	44	
Green	112	72	58	
Magenta	83	183	198	
Red	65	100	212	
Blue	34	212	114	
Black	16	128	128	

Table 4 Overlay and Background value settings (decimal).

5. Specification

Power: +9-14V (+12VDC nominal) @ ~350mA.

Dimensions: 120mm x 78mm x 27mm.

Video input: SDI (SMPTE-259M), HD-SDI (SMPTE-292M), 3G-SDI (SMPTE-425M).
                            >15dB return loss.

Video output: SDI/HD-SDI/3G-SDI. >15dB return loss.

Characters: 112 characters. 12 pixels x 16 lines.

Maximum display size: 128 x 64 characters.

Operating temperature: -10 – +40 degC.

Appendix A: AC-DC adaptor

The specification for the supplied AC-DC adaptor is shown in Figures 7 and 8.

CUI Inc | SERIES: SMI36 | DESCRIPTION: AC-DC POWER SUPPLY   date 06/23/2022 | page 2 of 5

INPUT

parameter	conditions/description	min	typ	max	units
voltage		90		264	Vac
frequency		47		63	Hz
current				1	A
inrush current	at 230 Vac, full load, 25°C, cold start			70	A
leakage current				0.25	mA
no load power consumption	at 115/230 Vac			0.075	W

OUTPUT

parameter	conditions/description	min	typ	max	units
regulation			±5		%
hold-up time	at full load	10			ms

PROTECTIONS

parameter	conditions/description	min	typ	max	units
over voltage protection	output shut down			180	%
over current protection	output shut down, auto recovery			170	%
short circuit protection	output shut down, auto recovery				

SAFETY & COMPLIANCE

parameter	conditions/description	min	typ	max	units
isolation voltage	input to output at 10 mA for 1 minute		3,000		Vac
isolation resistance	input to output at 500 Vdc	10			MΩ
safety approvals	UL/cUL (60950-1, 62368-1), RCM, CCC, PSE, UKCA				
EMI/EMC	FCC Part 15B Class B, CE				
MTBF	as per Telcordia SR-332, 25°C	300,000			hours
RoHS	yes				

ENVIRONMENTAL

parameter	conditions/description	min	typ	max	units
operating temperature		0		40	°C
storage temperature		-20		80	°C
operating humidity	non-condensing	20		80	%
storage humidity	non-condensing	10		90	%

Figure 7 Power supply specification: electrical.

MECHANICAL

parameter	conditions/description	min	typ	max	units
dimensions	79 x 35 x 66				mm
inlet plug	interchangeable blades (North America, Europe, UK, Australia, China)				
ac blade clip type	pinch clip				
weight	without blades			160	g

MECHANICAL DRAWING

units: mm
tolerance: ±1.0 mm
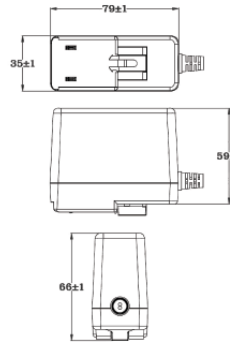
	INTERCHANGEABLE BLADES				
BLADE DESIGNATOR	N	E	B	A	C
REGION	North America	Europe	UK	Australia	China
BLADE ACCESSORY	SMI-US-2	SMI-EU-2	SMI-UK-2	SMI-AU-2	SMI-CN-2
BLADE	US (N)	Europe (E)	UK (B)	Australia (A)	China (C)

79±1
35±1
59±1
66±1

DC CORD

units: mm
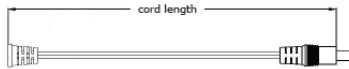
cord length

Table 1

MODEL NO.	CABLE	CORD LENGTH
SMI36-5	UL2468, 16 AWG	1,000 mm ±30
SMI36-9	UL2468, 18 AWG	1,500 mm ±30
SMI36-12	UL2468, 16 AWG	1,500 mm ±30
SMI36-15	UL2468, 18 AWG	1,500 mm ±30
SMI36-24	UL2468, 20 AWG	1,500 mm ±30
SMI36-48	UL2468, 22 AWG	1,500 mm ±30

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Figure 8 Power supply specification: mechanical.