multisoft
GROUP

VIDEO GRABBER

Technical Manual

Version	Date	Description	Author
1.0	27.04.2015	New document	PP
1.1	28.04.2015	Revised to match software version 1.8	PP
1.2	26.10.2015	Revised to match software version 1.10	BG
1.3	20.12.2015	Revised to match software version 1.13	MM
1.4	17.03.2016	Revised to match software version 1.19	MM

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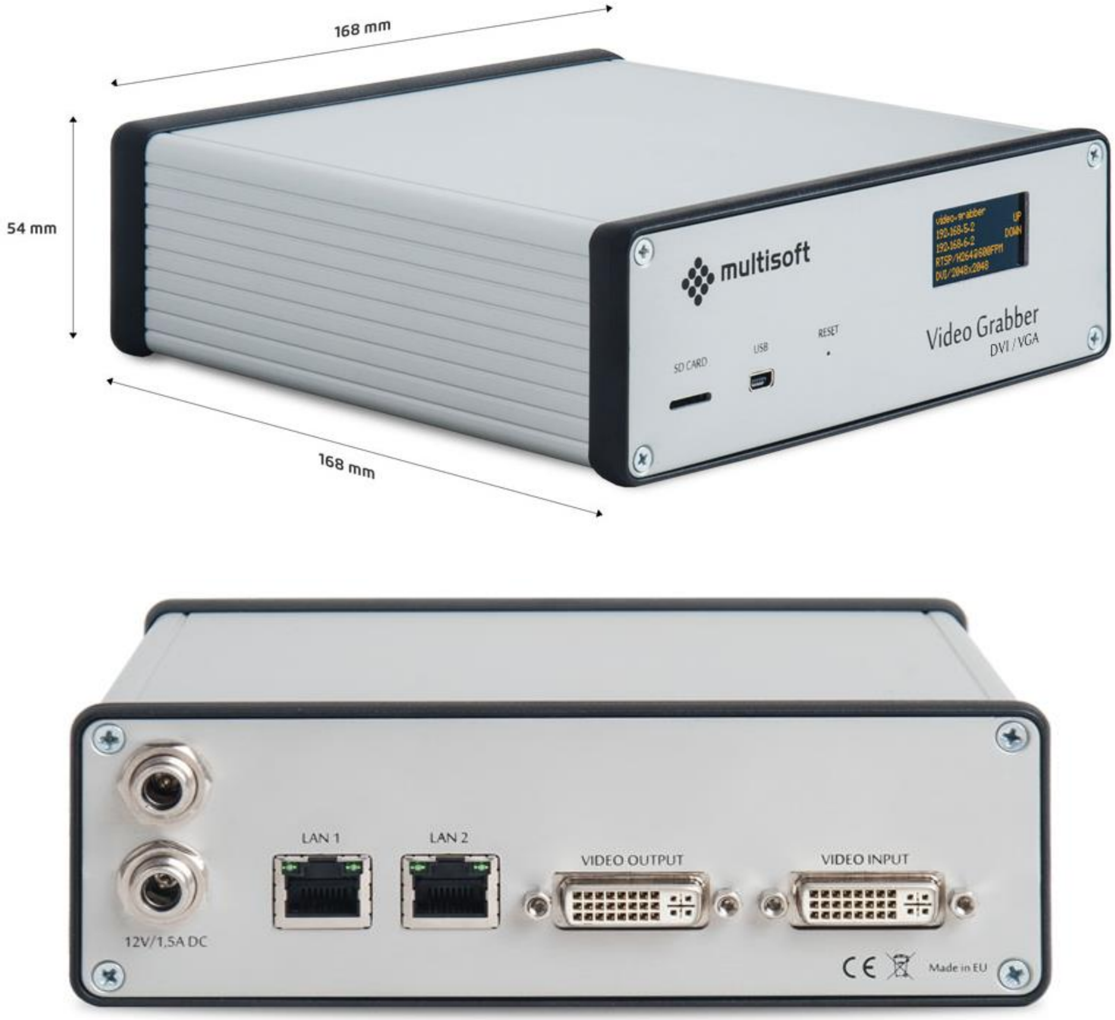
1. Features

Multisoft Video Grabber is a device that captures video signal between Graphics Card and Monitor. Armed with two DVI-I video sockets, for capturing Analogue (using D-SUB to DVI adaptor or hybrid cable) as well as digital signal using Digital Virtual Interface cables. Captured video can be send via two independent Gigabit Ethernet ports to two separated recorders. Video Capturing process is non-intrusive.*

* DDC2B compliant video signal if the Graphics Adapter providing 5V, 700 mA on pin 14 of DVI connector

1.1. Technical Specification



Video Grabber VGA / DVI

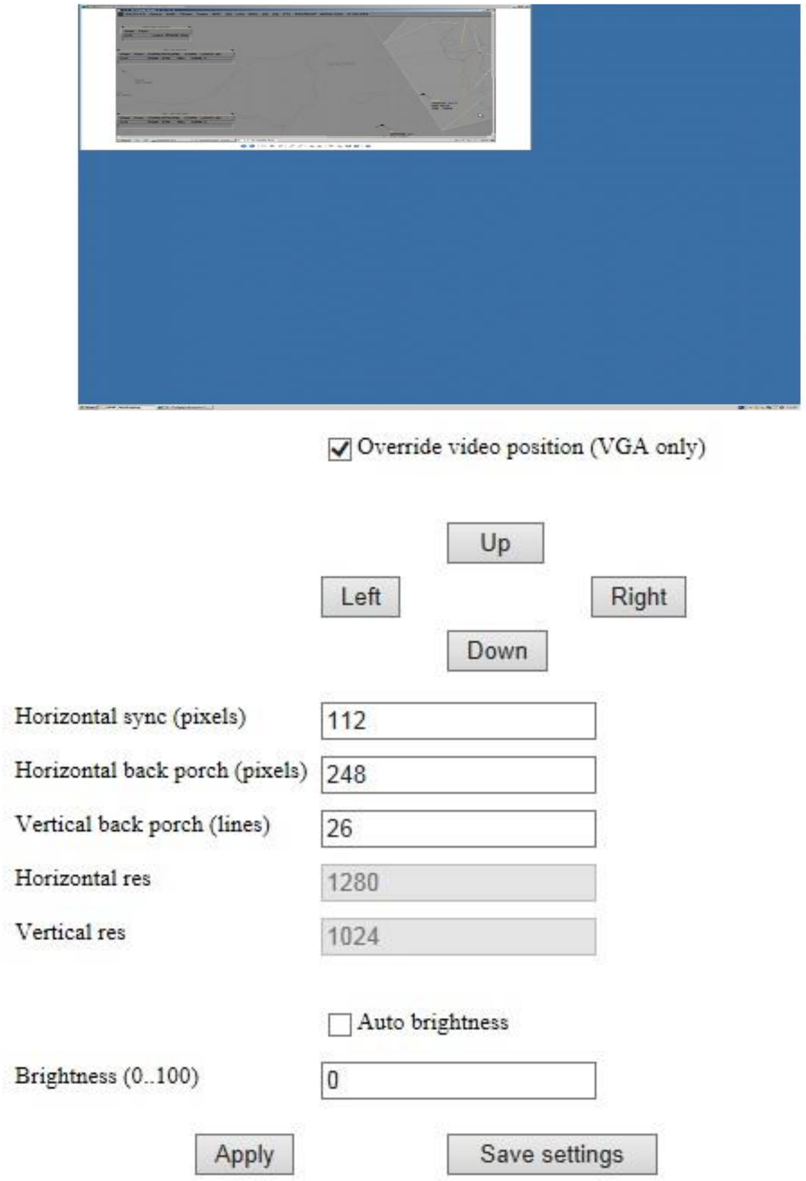
Video resolution (VGA)	up to 1920x1200 (with pixel clock limitation up to 165 MHz)
Video resolution (SL DVI)	up to 1920x1200
Video resolution (DL DVI)	up to 2560x1600 (2048x2048) (1920x2160)
Captured video format	BMP, PNG, JPEG2000, H.264, Lossless
Operating Temperature	0 – 55 °C
Dimensions	168x168x54 [mm]
Weight	0,9 kg
Power source	DC Adapter 12V, 2A (with optional redundancy)
Video Input/output	2x DVI-I (24 + 5 pin) sockets for capturing video signal (VGA -> DVI adaptors required for capturing analogue signal; not included)
Output	2x Gigabit Ethernet NIC’s for transferring captured video

Table 1: Technical specification

2. Video adjustment

2.1. Preview & adjust

In *Preview & adjust* tab of Video Grabber Web Interface allowing to modify or correct detected video setting. Because of many manufacturers and display types, detected analogue video parameters are not always satisfactory. To do this, override video position (VGA only check button must be active). This option activate captured video positon correction as well as change basic video Modeline settings. All available options are shown on **Figure 1. Screen adjustment**.



☑ Override video position (VGA only)

Horizontal sync (pixels) 112

Horizontal back porch (pixels) 248

Vertical back porch (lines) 26

Horizontal res 1280

Vertical res 1024

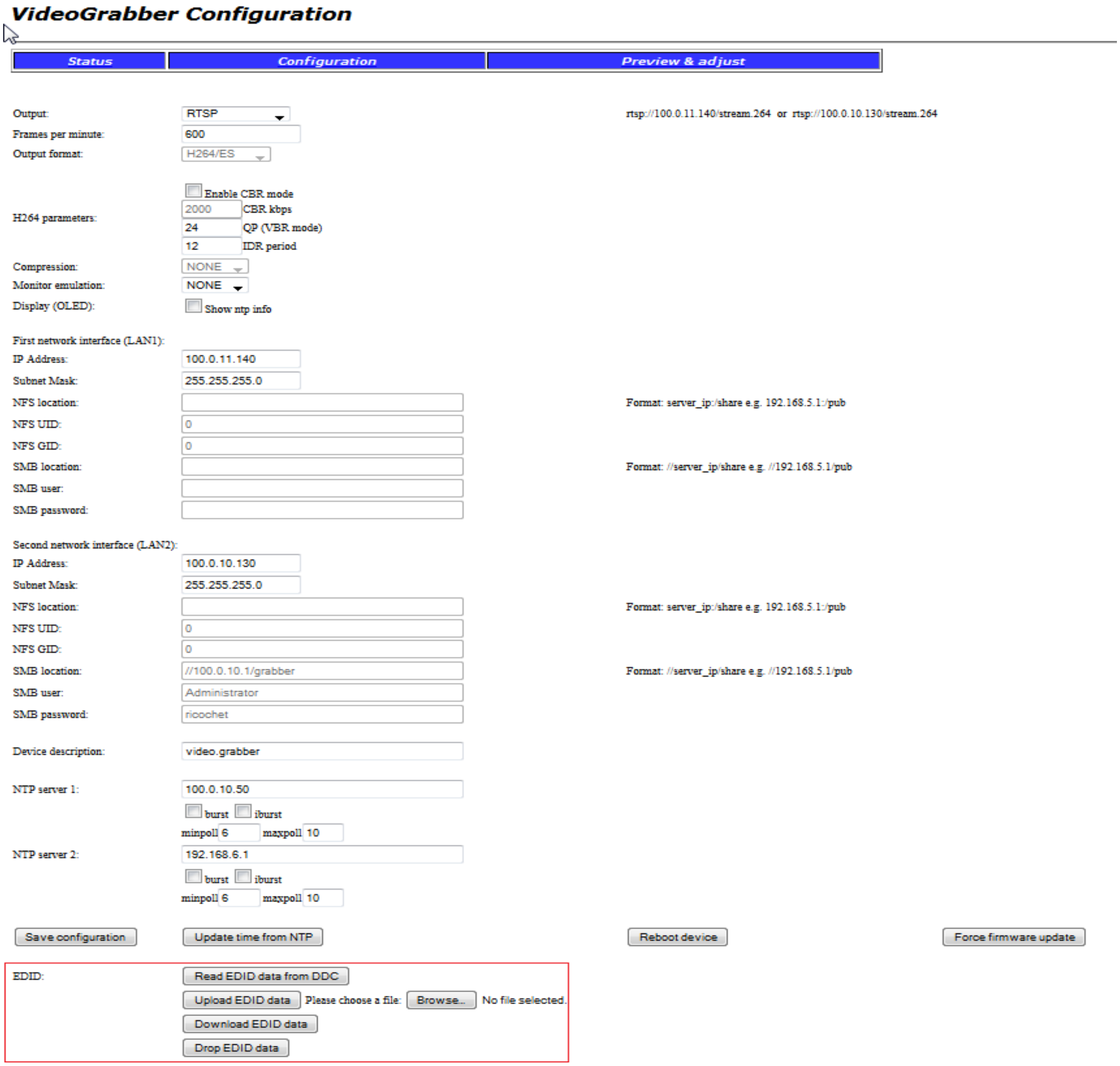
□ Auto brightness

Brightness (0..100) 0

Figure 1. Screen adjustment

2.2. Extended Display Identification Data (EDID).

Video Grabber is designed to work with many different types and models of analog display devices. In order to receive correct parameters of display device or monitor, we use information that can be obtained directly from a connected device. For this purpose, we will use the EDID section in the *Configuration* tab.



VideoGrabber Configuration

Output:	RTSP	rtsp://100.0.11.140/stream.264 or rtsp://100.0.10.130/stream.264
Frames per minute:	600	
Output format:	H264/ES	
H264 parameters:	□ Enable CBR mode 2000 CBR kbps 24 QP (VBR mode) 12 IDR period	
Compression:	NONE	
Monitor emulation:	NONE	
Display (OLED):	□ Show ntp info	
First network interface (LAN1):		
IP Address:	100.0.11.140	
Subnet Mask:	255.255.255.0	
NFS location:		Format: server_ip:/share e.g. 192.168.5.1:/pub
NFS UID:	0	
NFS GID:	0	
SMB location:		Format: //server_ip/share e.g. //192.168.5.1/pub
SMB user:		
SMB password:		
Second network interface (LAN2):		
IP Address:	100.0.10.130	
Subnet Mask:	255.255.255.0	
NFS location:		Format: server_ip:/share e.g. 192.168.5.1:/pub
NFS UID:	0	
NFS GID:	0	
SMB location:	//100.0.10.1/grabber	Format: //server_ip/share e.g. //192.168.5.1/pub
SMB user:	Administrator	
SMB password:	ricochet	
Device description:	video.grabber	
NTP server 1:	100.0.10.50 □ burst □ iburst minpoll 6 maxpoll 10	
NTP server 2:	192.168.6.1 □ burst □ iburst minpoll 6 maxpoll 10	

EDID:

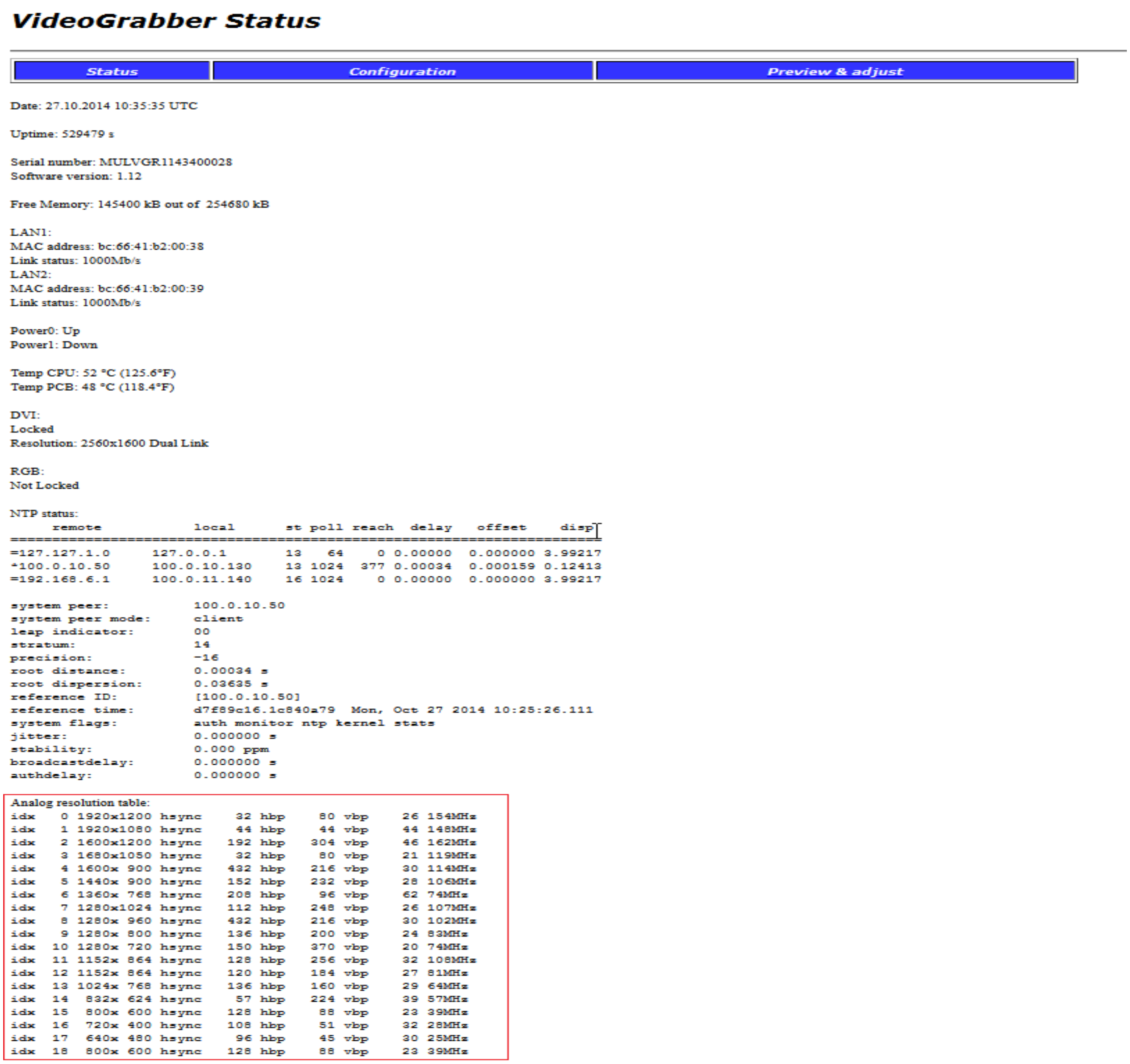
Please choose a file: No file selected.

Figure 2. Video Grabber Configuration – EDID section

Item	Description
Read EDID data from DDC	Reading all supported Modelines reported by connected device and use this data as new EDID table.
Upload EDID data	Allow to upload previously saved EDID data from disk.
Download EDID data	Allow to save EDID table to disk.
Drop EDID data	Clear EDID table in device and load default EDID table.

Table 2. Video Grabber EDID sections parameter description

In order to check currently used EDID table please use *Status* tab in web-based Video Grabber interface as is shown on **Figure 3. Video Grabber Status Tab – EDID table.**



VideoGrabber Status

Date: 27.10.2014 10:35:35 UTC

Uptime: 529479 s

Serial number: MULVGR1143400028
Software version: 1.12

Free Memory: 145400 kB out of 254680 kB

LAN1:
MAC address: bc:66:41:b2:00:38
Link status: 1000Mb/s
LAN2:
MAC address: bc:66:41:b2:00:39
Link status: 1000Mb/s

Power0: Up
Power1: Down

Temp CPU: 52 °C (125.6°F)
Temp PCB: 48 °C (118.4°F)

DVI:
Locked
Resolution: 2560x1600 Dual Link

RGB:
Not Locked

NTP status:

```
     remote           local      st poll reach  delay   offset    disp
=======================================================================
=127.127.1.0     127.0.0.1       13   64    0 0.00000  0.000000 3.99217
*100.0.10.50     100.0.10.130    13 1024  377 0.00034  0.000159 0.12413
=192.168.6.1     100.0.11.140    16 1024    0 0.00000  0.000000 3.99217

system peer:          100.0.10.50
system peer mode:     client
leap indicator:       00
stratum:              14
precision:            -16
root distance:        0.00034 s
root dispersion:      0.03635 s
reference ID:         [100.0.10.50]
reference time:       d7f89c16.1c840a79  Mon, Oct 27 2014 10:25:26.111
system flags:         auth monitor ntp kernel stats
jitter:               0.000000 s
stability:            0.000 ppm
broadcastdelay:       0.000000 s
authdelay:            0.000000 s
```

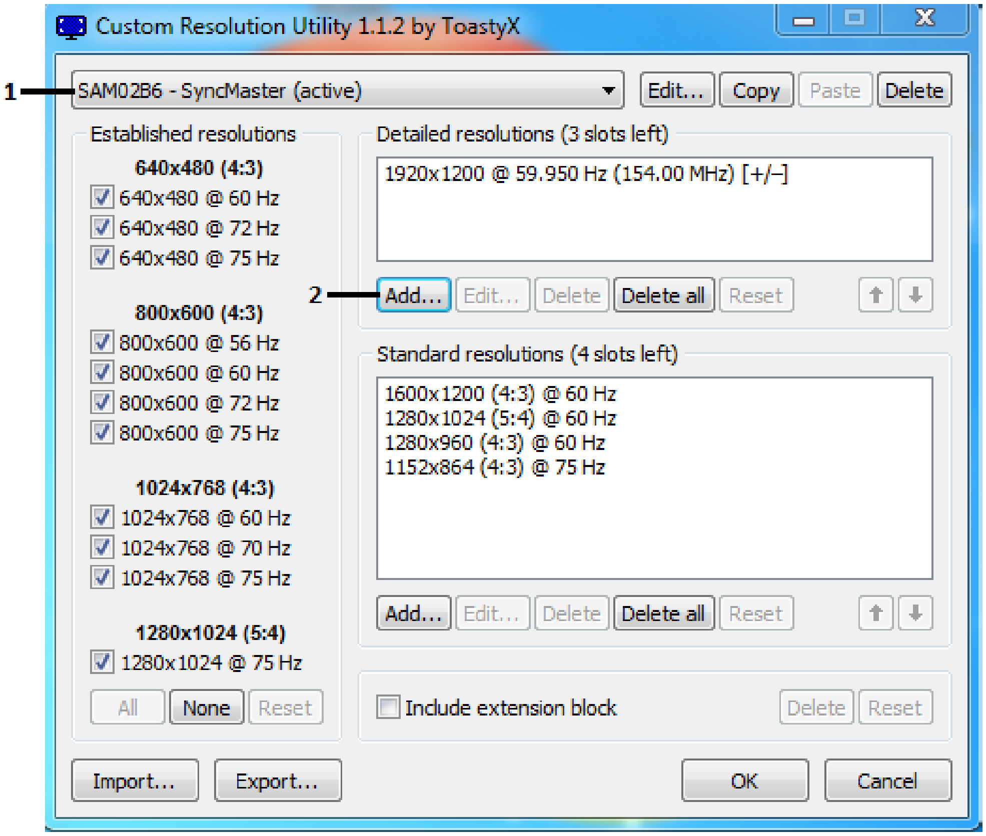
Analog resolution table:

```
idx   0 1920x1200 hsync   32 hbp   80 vbp   26 154MHz
idx   1 1920x1080 hsync   44 hbp   44 vbp   44 148MHz
idx   2 1600x1200 hsync  192 hbp  304 vbp   46 162MHz
idx   3 1680x1050 hsync   32 hbp   80 vbp   21 119MHz
idx   4 1600x 900 hsync  432 hbp  216 vbp   30 114MHz
idx   5 1440x 900 hsync  152 hbp  232 vbp   28 106MHz
idx   6 1360x 768 hsync  208 hbp   96 vbp   62 74MHz
idx   7 1280x1024 hsync  112 hbp  248 vbp   26 107MHz
idx   8 1280x 960 hsync  432 hbp  216 vbp   30 102MHz
idx   9 1280x 800 hsync  136 hbp  200 vbp   24 83MHz
idx  10 1280x 720 hsync  150 hbp  370 vbp   20 74MHz
idx  11 1152x 864 hsync  128 hbp  256 vbp   32 108MHz
idx  12 1152x 864 hsync  120 hbp  184 vbp   27 81MHz
idx  13 1024x 768 hsync  136 hbp  160 vbp   29 64MHz
idx  14  832x 624 hsync   57 hbp  224 vbp   39 57MHz
idx  15  800x 600 hsync  128 hbp   88 vbp   23 39MHz
idx  16  720x 400 hsync  108 hbp   51 vbp   32 28MHz
idx  17  640x 480 hsync   96 hbp   45 vbp   30 25MHz
idx  18  800x 600 hsync  128 hbp   88 vbp   23 39MHz
```

Figure 3. Video Grabber Status Tab – EDID table

2.2.1. Calculating custom Modeline.

In some hardware configurations, you need to calculate custom Modeline because of the screen resolution, which has not been sent from the display to Video Grabber via EDID (Extended Display Identification Data) or because Pixel Clock of this resolution is higher than supported by device. Some Graphics Adapters are provided tools to set or check actual Modeline but not all graphics drivers display this information. In this case, you will need additional software to calculate custom one which will be properly recognized by device. The 3rdparty tool, called Custom Resolution Utility (CRU) will be useful. You can download it from http://www.monitortests.com/cru-1.2.6.zip.
No installation is necessary. Simply run CRU.exe and main program window will be displayed as is shown on the **Figure 4. CRU – main window**.



Custom Resolution Utility 1.1.2 by ToastyX

SAM02B6 - SyncMaster (active)

Established resolutions

640x480 (4:3)
☑ 640x480 @ 60 Hz
☑ 640x480 @ 72 Hz
☑ 640x480 @ 75 Hz

800x600 (4:3)
☑ 800x600 @ 56 Hz
☑ 800x600 @ 60 Hz
☑ 800x600 @ 72 Hz
☑ 800x600 @ 75 Hz

1024x768 (4:3)
☑ 1024x768 @ 60 Hz
☑ 1024x768 @ 70 Hz
☑ 1024x768 @ 75 Hz

1280x1024 (5:4)
☑ 1280x1024 @ 75 Hz

Detailed resolutions (3 slots left)

1920x1200 @ 59.950 Hz (154.00 MHz) [+/-]

Standard resolutions (4 slots left)

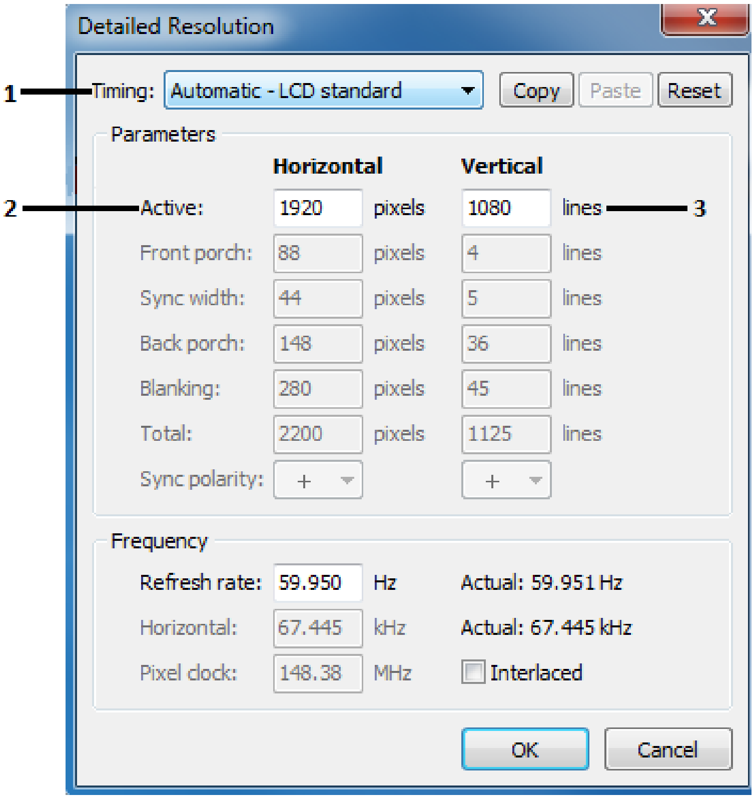
1600x1200 (4:3) @ 60 Hz
1280x1024 (5:4) @ 60 Hz
1280x960 (4:3) @ 60 Hz
1152x864 (4:3) @ 75 Hz

☐ Include extension block

Figure 4. CRU – main window

1. From Drop Box (**1**), please select monitor which one is used for display custom resolution. This utility take information about connected monitors directly from Windows registry, so this list should be up-to-date. This option is useful only when we calculate Modeline on the system which will be recorded. If another computer is used to calculate Modeline just leave this option on default value.
2. Because expected resolution is not displayed in any place click Add... button (**2**) for add it.

   After clicking on the add button, new window appears, where you can set and read parameters necessary to calculate new *Modeline* for the required resolution.



Detailed Resolution

Timing: Automatic - LCD standard

Parameters

	Horizontal		Vertical	
Active:	1920	pixels	1080	lines
Front porch:	88	pixels	4	lines
Sync width:	44	pixels	5	lines
Back porch:	148	pixels	36	lines
Blanking:	280	pixels	45	lines
Total:	2200	pixels	1125	lines
Sync polarity:	+		+	

Frequency

Refresh rate:	59.950	Hz	Actual: 59.951 Hz
Horizontal:	67.445	kHz	Actual: 67.445 kHz
Pixel clock:	148.38	MHz	□ Interlaced

Figure 5. New custom resolution add window.

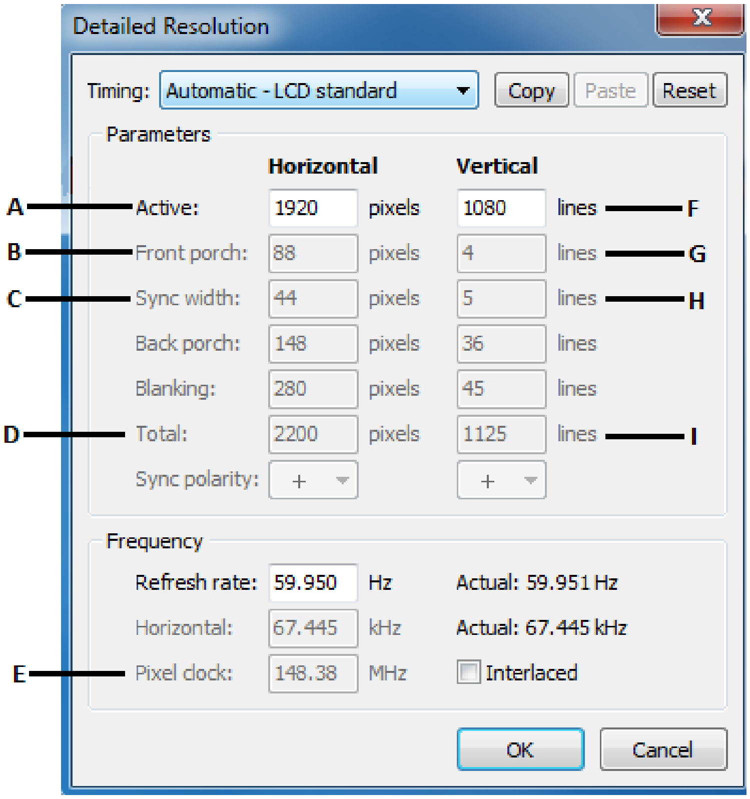
3. From timing Drop-Box button please select Automatic – LCD standard (**1**).
4. In the two fields below please type horizontal number of pixels (**2**) and vertical number of lines **(3).** All remaining fields will be filled automatically.

2.2.2. Modeline string format.

In order to understanding Modeline structure, please refer to Figure 6. Example of Modeline string for resolution 1920x1080. Every single parameter of this string is necessary for device to properly capture analogue signal. Each of them including referred field in Modeline calculator is described later in this section. Let's take a look how this string is build. Please refer to **Figure 6. Example of Modeline string for resolution 1920x1080** .

1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**
Modeline	"1920x1080"	148	1920	2008	2052	2200	1080	1084	1089	1125	-hsync	+vsync

Figure 6. Example of Modeline string for resolution 1920x1080.



Detailed Resolution

Timing: Automatic - LCD standard

Parameters

	Horizontal		Vertical	
Active:	1920	pixels	1080	lines
Front porch:	88	pixels	4	lines
Sync width:	44	pixels	5	lines
Back porch:	148	pixels	36	lines
Blanking:	280	pixels	45	lines
Total:	2200	pixels	1125	lines
Sync polarity:	+		+	

Frequency

Refresh rate: 59.950 Hz Actual: 59.951 Hz

Horizontal: 67.445 kHz Actual: 67.445 kHz

Pixel clock: 148.38 MHz □ Interlaced

Figure 7. Modeline calculation

Parameter	Description	Value
1	Constant value: Modeline	**Modeline**
2	Modeline text description	**Text**
3	Pixel clock	**E**
4	Expected horizontal pixels	**A**
5	Expected horizontal pixels + front porch	**A + B**
6	Expected horizontal pixels + front porch + sync width	**A + B + C**
7	Total horizontal pixels	**D**
8	Expected vertical lines	**F**
9	Expected vertical lines + front porch	**F + G**
10	Expected vertical lines + front porch + sync width	**F + G + H**
11	Total vertical lines	**I**
12	Horizontal sync polarity	**+hsync / -hsync**
13	Vertical sync polarity	**+vsync / -vsync**

Table 3. Modeline parameters description table (ref. to Figure 7 for values).

First parameter **(1)** is constant value and should be typed directly as *Modeline*.
Second parameter **(2)** is text value for easiest Modeline identification. This parameter must be between quotes. In this example we define resolution 1920x1080 then, for recognize this Modeline, text string is “1920x1080”.

Next parameter **(3)**, is Pixel Clock. As we can see on screen it is 148.38 **(E)**. Because this value should be integer, then type 148.

Fourth one **(4)** is expected horizontal resolution in pixels. Because in this example we want to set 1920x1080, then we type 1920 as **(A)**.

Next one **(5)** is sum of expected horizontal resolution and front porch **(A+B)**, so (1920 + 88 = 2008).

Sixth parameter **(6)** is sum of expected horizontal resolution **(A),** front porch **(B)** and sync width **(C)** then (1920 + 88 + 44 = 2052).

Next parameter **(7)** is horizontal pixel total. In this example it is 2200**(D)**.

Parameters from **8** to **11** are responsible for vertical settings.

Parameter **(8)** is the required number of vertical lines **(F)**, in this case - 1080.

Next **(9)** is the sum of the required vertical lines **(F)** and front porch **(G),** then (1080 + 4 = 1084).

Another one **(10)** is sum of required vertical lines **(F),** front porch **(G)** and sync width **(H)** then result is: (1080 + 4 + 5 = 1089).

The last one numeric parameter **(11)** is total number of vertical lines **(I)** in this example, 1125.

Last two parameters in *Modeline,* string are horizontal **(12)** and vertical **(13)** sync polarity. This parameters are used the remaining signal polarity combination to detect high resolution modes in the same horizontal pixels value on multiscan monitors. Only four combinations are possible:

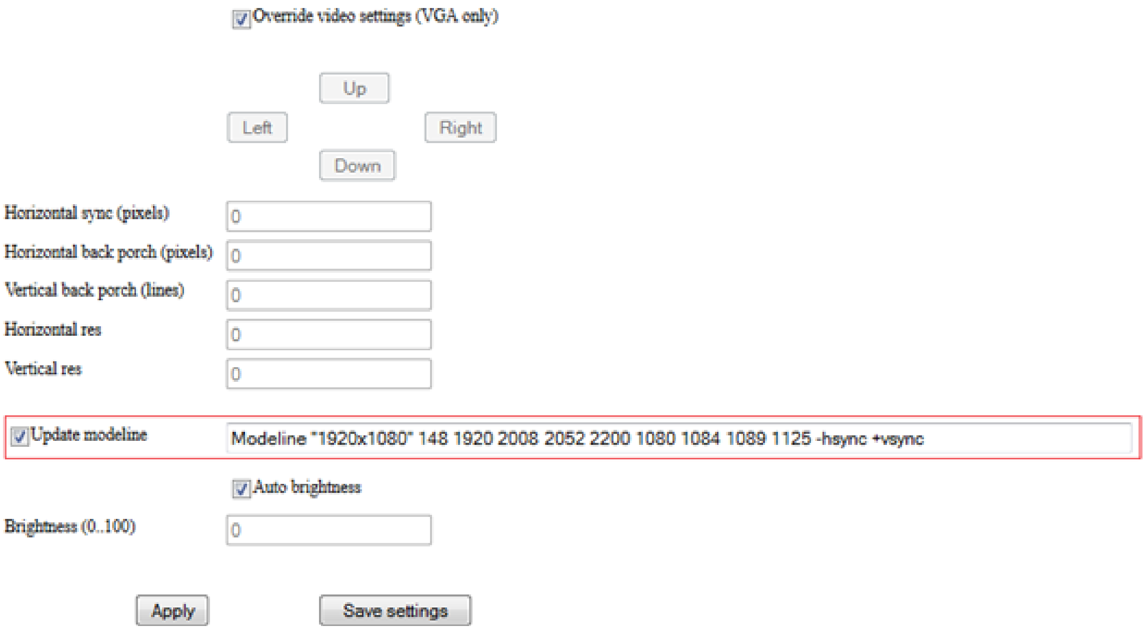
([**+hsync** / **+vsync**], [**+hsync** / **-vsync**], [**-hsync** / **+vsync**], **[-hsync** / -**vsync**]).

All parameters in Modeline string are space separated, different separation symbol is not acceptable and take no effect with device.

2.2.3. Deploying custom Modeline using Video Grabber Web Interface.

In *Preview & Adjust* tab is a special field, where we can define our custom modeline. To do that *Override video position (VGA only)* and *Update modeline* checkboxes, must be checked.
In highlighted text field (see fig. 15), please enter newly calculated modeline in correct syntax and click *Apply* button to check it. If this new modeline is calculated correctly, captured screen should be appear in preview window and detected signal type and resolution, should be visible on device status LCD display. Finally press *Save settings* button, to save this modeline into device EDID table.

Notice: *Any changes made to previously defined Modeline, will **REPLACE** this Modeline in device EDID table. Please make backup of you current EDID table before use this utility and use it carefully, because wrong defined Modeline will result no video capture from connected device.*



☑ Override video settings (VGA only)

Horizontal sync (pixels) 0
Horizontal back porch (pixels) 0
Vertical back porch (lines) 0
Horizontal res 0
Vertical res 0

☑ Update modeline Modeline "1920x1080" 148 1920 2008 2052 2200 1080 1084 1089 1125 -hsync +vsync

☑ Auto brightness

Brightness (0..100) 0

Appendix A – Video Grabber protocol v2

Data is streamed using UDP packets. Every frame is identified by header that is formatted:

MAGIC: 4 * UCHAR header: ‘V’ ‘G’ ‘B’ ‘R’
VER: UCHAR version: 0x01
VID_TYP: UCHAR frame type:
Bits 2:0 – video frame format:
0x0 – Microsoft BMP,
0x1 – PNG,
0x2 – JPEG2000,
0x3 – JPEG,
0x4 – RAW,
0x5 – H264/ES,
0x6 – LOSSLESS
Bit 3 – compression settings:
0x0 – no compression,
0x1 – ZIP compression
Bit 4 – CRC settings for video data:
0x0 – CRC disabled on VID_DATA, VID_CRC field has no correct data,
0x1 – CRC enabled on VID_DATA, VID_CRC field has correct data
Bits 7:5 – unused, reserved for future use

VID_NUM: USHORT next frame number,
VID_LEN: UINT length of the frame,
VID_SEC: UINT frame timestamp (seconds), time 0 ≥ 1970-01-01 00:00:00 +0000 (UTC),
VID_USEC: UINT frame timestamp (microseconds), time 0 ≥ 1970-01-01 00:00:00 +0000 (UTC),
VID_CRC: USHORT Video frame CRC, includes VID_LEN bytes of VID_DATA field: crc16-ccitt,
HDR_CRC: USHORT header CRC, includes bytes from MAGIC to VID_CRC: crc16-ccitt,
VID_DATA: VID_LEN * UCHAR data from video frame.

Types of data:
UCHAR – one byte field,
USHORT – two byte field written according to network notation,
UINT – four byte field written according to network notation,

Pseudo C description, assuming that:
Unsigned char = 8 bitts,
Unsigned short = 16 bitts,
Unsigned int = 32 bitts,

Structure is packed

```
typedef struct {
                        unsigned char[4]    MAGIC;
                        unsigned char       VER;
                        unsigned char       VID_TYP;
                        unsigned short      VID_NUM;
                        unsigned int        VID_LEN;
                        unsigned short      VID_CRC;
                        unsigned int        VID_SEC;
                         unsigned int       VID_USEC;
                        unsigned short       HDR_CRC;
                        unsigned char[VID_LEN] VID_DATA;
                        }
VideoGrabber_PseudoFrame_t;
```

After connecting to device, bytes ‘V’ ‘G’ ‘B’ ‘R’ must be found. After that if CRC from header and CRC in the structure are the same, the beginning of sequence has been found. If they are different then we can assume that synchronization bytes occurred as an element of video frame, so next header has to be found. After finding right header, next one doesn’t have to be found, because it can be calculated:
Next_fram_off = current_frame_off + sizeof (VideoGrabber_PseudoFrame_t).
In case of losing some data (network problems) synchronization process has to be repeated.

Appendix B – Supported resolutions

Horizontal(pixel)	Vertical(lines)	Refresh Rate(Hz)	VGA	DVI
640	480	60	✓	✓
720	400	70	✓	✓
800	600	60	✓	✓
832	624	75	✓	✓
1024	768	60	✓	✓
1152	864	60	✓	✓
1152	864	75	✓	✓
1280	600	60		✓
1280	720	60	✓	✓
1280	800	60	✓	✓
1280	960	60	✓	✓
1280	1024	60	✓	✓
1360	768	60	✓	✓
1400	1050	60		✓
1440	900	60	✓	✓
1600	900	60	✓	✓
1600	1200	60	✓	✓
1680	1050	60	✓	✓
1920	1080	60	✓	✓
1920	1200	60	✓	✓
1920	1440	60		✓
2048	1536	60		✓
2048	2048	60		✓

Table 4. Video Grabber VGA / DVI - Supported resolutions table

✓ - It’s required to set CVT reduced blank in driver’s settings.

✓ - DVI Dual Link Cable is required.