



VSourceV4L2 C++ library

v2.1.2

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Overview

VSourceV4L2 C++ library provides video capture and video source (V4L2 compatible video sources) control function based on [V4L2 API](#). The library supports [stepwise and discrete devices](#). The library inherits interface from open source [VSource](#) interface class. The library inherits interface from open source [VSource](#) interface class. **VSource.h** file contains data structures [VSourceParams](#) class (contains video source params and provides methods for serialization / deserialization params), [VSourceCommand](#) enum (describes video source action commands), [VSourceParam](#) enum (describes video source params) and includes [VSourceOpenCv](#) class declaration. The library provides auto detection of supported resolution, format and fps. If particular devices doesn't support requested pixel format, resolution or fps, the library will set most appropriate parameters.

Versions

Table 1 - Library versions.

Version	Release date	What's new
1.0.0	13.01.2022	First version
1.1.0	20.06.2023	- Fixed bugs. - Documentation updated.
1.2.0	29.06.2023	- Added new parameters. - Documentation updated.
2.0.0	20.08.2023	- Added license. - Added example and updated test application. - Interface update according to VSource class. - Added automatic detection supported format and automatic choosing right format during initialization.
2.0.1	29.08.2023	- Fixed stepwise camera support issue. - Documentation updated.
2.0.2	30.08.2023	- Fixed stepwise camera pixel format setting.
2.0.3	17.11.2023	- Frame class updated.
2.0.4	17.11.2023	- Fixed initialization with string.
2.1.0	22.12.2023	- Region of interest support added.
2.1.1	27.12.2023	- Mistakes in ROI fixed.
2.1.2	09.01.2024	- Documentation updated.

Library files

The repository structure is shown below:

```
CMakeLists.txt ----- Main CMake file.
3rdparty ----- Folder with third-party libraries.
  CMakeLists.txt ----- CMake file to include third-party libraries.
  Logger ----- Folder with files of Logger library.
  VSource ----- Folder with files of VSource library.
src ----- Folder with library source code.
  CMakeLists.txt ----- CMake file.
  VSourceV4L2.h ----- Main library header file.
  VSourceV4L2Version.h ----- Header file with library version.
  VSourceV4L2Version.h.in --- File for CMake to generate version header.
  VSourceV4L2.cpp ----- C++ implementation file.
test ----- Folder for test application files.
  CMakeLists.txt ----- CMake file for test application.
  main.cpp ----- Source C++ file of demo application.
example ----- Folder for example application files.
  CMakeLists.txt ----- CMake file for example application.
  main.cpp ----- Source C++ file of example application.
```

Additionally test application depends on [OpenCV](#) library to provide user interface.

VSourceV4L2 class description

VSourceV4L2 class declaration

VSourceV4L2 class declared in **VSourceV4L2.h** file. Class declaration:

```
class VSourceV4L2 : public VSource
{
public:
    /// class constructor.
    VSourceV4L2();

    /// class destructor.
    ~VSourceV4L2();

    /// Get string of current library version.
    static std::string getVersion();

    /// Open video source.
    bool openVSource(std::string& initString) override;

    /// Init video source.
    bool initVSource(VSourceParams& params) override;
```

```

    /// Get open status.
    bool isVSourceOpen() override;

    /// Close video source.
    void closeVSource() override;

    /// Get new video frame.
    bool getFrame(Frame& frame, int32_t timeoutMsec = 0) override;

    /// Set video source param.
    bool setParam(VSourceParam id, float value) override;

    /// Get video source param value.
    float getParam(VSourceParam id) override;

    /// Get video source params structure.
    void getParams(VSourceParams& params) override;

    /// Execute command.
    bool executeCommand(VSourceCommand id) override;
};

```

getVersion method

getVersion() method returns string of current version of **VSourceV4L2** class. Method declaration:

```
static std::string getVersion();
```

Method can be used without **VSourceV4L2** class instance:

```
cout << "VSourceV4L2 class version: " << VSourceV4L2::getVersion() << endl;
```

Console output:

```
VSourceV4L2 class version: 2.1.2
```

openVSource method

openVSource(...) method initializes video source. Video source params ([VSourceParams](#) class) will be initialized by default. Instead of **openVSource(...)** method user can call [initVSource\(...\)](#) method. Method declaration:

```
bool openVSource(std::string& initString) override;
```

Parameter	Value
initString	<p>Initialization string. Valid formats: [full device name];[width];[height];[fps];[fourcc] or [full device name];[width];[height];[fps] or [full device name];[width];[height] or [full device name]</p> <p>Initialization string parameters: [full device name] - Full name of video device in Linux OS. Default name format: /dev/video0, /dev/video1 etc. or can be /dev/v4l/by-id/... in case UVC compatible cameras. [width] - Video frame width. Video frame height must be set as well. The library will try set this value in video capture hardware parameters. If set to 0 the library will detect frame width automatically according to existing video device parameters. [height] - Video frame height. Video frame width must be set as well. The library will try set this value in video capture hardware parameters. If set to 0 the library will detect frame width automatically according to existing video device parameters. [fps] - FPS. The library will try set this value in video capture hardware parameters. If set to 0 the library will detect frame width automatically according to existing video device parameters. [fourcc] - Pixel format. Valid values: BGR24, RGB24, GRAY, YUV24, YUYV, UYVY, NV12, NV21, YV12, YU12. If fourcc not set the library will chose appropriate format according to existing video device parameters.</p>

Returns: TRUE if the video source open or FALSE if not.

initVSource method

initVSource(...) method designed to initialize video source by set of parameters. Instead of **initVSource(...)** method user can call [openVSource\(...\)](#). Method declaration:

```
bool initVSource(VSourceParams& params) override;
```

Parameter	Value
params	VSourceParams class. The video source will set parameters according to params structure. If particular parameters not valid the library will set it to default.

Returns: TRUE if the video source initialized or FALSE if not.

isVSourceOpen method

isVSourceOpen() method returns video source initialization status. Initialization status also included in [VSourceParams](#) class. Method declaration:

```
bool isVSourceOpen() override;
```

Returns: TRUE if the video source open (initialized) or FALSE if not.

closeVSource method

closeVSource() method intended to close video source. Method declaration:

```
void closeVSource() override;
```

getFrame method

getFrame(...) method returns video frame. Video source supports auto reinitialization in case connection loss. Method declaration:

```
bool getFrame(Frame& frame, int32_t timeoutMsec = 0) override;
```

Parameter	Value
frame	Output video frame (see Frame class description). Video source class determines output pixel format. Pixel format can be set in initVSource(...) or openVSource(...) methods but if specified pixel format not supported by hardware the library can return Frame object with different pixel format.
timeoutMsec	Timeout to wait new frame data, milliseconds: - timeoutMs == -1 - Method will wait endlessly until new data arrive. - timeoutMs == 0 - Method will only check if new data exist. - timeoutMs > 0 - Method will wait new data specified time.

Returns: TRUE if new frame exists and copied or FALSE if not (wait timeout expired or video source not initialized).

setParam method

setParam(...) method designed to set new video source parameters value. Method will set parameters to device. Method can be used only after video source initialization. Method declaration:

```
bool setParam(VSourceParam id, float value) override;
```

Parameter	Description
id	Video source parameter ID according to VSourceParam enum.
value	Video source parameter value.

Returns: TRUE if the parameter was set or FALSE if not (not valid value or not supported).

getParam method

getParam(...) method designed to obtain video source parameter value. Method will request parameters from device. Method can be used only after video source initialization. Method declaration:

```
float getParam(VSourceParam id) override;
```

Parameter	Description
id	Video source parameter ID according to VSourceParam enum.

Returns: parameter value or -1 of the parameter not supported.

getParams method

getParams(...) method designed to obtain video source params class. Method declaration:

```
void getParams(VSourceParams& params) override;
```

Parameter	Description
params	VSourceParams class.

executeCommand method

executeCommand(...) method executes video source command. Method declaration:

```
bool executeCommand(VSourceCommand id) override;
```

Parameter	Description
id	Video source action command ID according to VSourceCommand enum.

Returns: TRUE is the command was executed or FALSE if not.

decodeAndExecuteCommand method

decodeAndExecuteCommand(...) method decodes and executes command on video source side. Method will decode commands which encoded by [encodeCommand\(...\)](#) and [encodeSetParamCommand\(...\)](#) methods of VSource interface class. If command decoded the method will call [setParam\(...\)](#) or [executeCommand\(...\)](#) methods. **decodeAndExecuteCommand(...)** is thread-safe. This means that the method can be safely called from any thread. Method declaration:

```
bool decodeAndExecuteCommand(uint8_t* data, int size) override;
```

Parameter	Description
data	Pointer to input command.
size	Size of command. Must be 11 bytes for SET_PARAM and 7 bytes for COMMAND.

Returns: TRUE if command decoded (SET_PARAM or COMMAND) and executed or FALSE if not.

encodeSetParamCommand method of VSource interface class

encodeSetParamCommand(...) static method of [VSource](#) interface class designed to encode command to change any parameter for remote video source. To control video source remotely, the developer has to design his own protocol and according to it encode the command and deliver it over the communication channel. To simplify this, the [VSource](#) class contains static methods for encoding the control command. The [VSource](#) class provides two types of commands: a parameter change command (SET_PARAM) and an action command (COMMAND). **encodeSetParamCommand(...)** method encodes SET_PARAM command. Method declaration:

```
static void encodeSetParamCommand(uint8_t* data, int& size, VSourceParam id, float value);
```

Parameter	Description
data	Pointer to data buffer for encoded command. Must have size >= 11.
size	Size of encoded data. Will be 11 bytes.
id	Parameter ID according to VSourceParam enum.
value	Parameter value.

SET_PARAM command format:

Byte	Value	Description
0	0x01	SET_PARAM command header value.
1	Major	Major version of VSource class.
2	Minor	Minor version of VSource class.
3	id	Parameter ID int32_t in Little-endian format.
4	id	Parameter ID int32_t in Little-endian format.
5	id	Parameter ID int32_t in Little-endian format.
6	id	Parameter ID int32_t in Little-endian format.
7	value	Parameter value float in Little-endian format.
8	value	Parameter value float in Little-endian format.

Byte	Value	Description
9	value	Parameter value float in Little-endian format.
10	value	Parameter value float in Little-endian format.

encodeSetParamCommand(...) is static and used without [VSource](#) class instance. This method used on client side (control system). Command encoding example:

```
// Buffer for encoded data.
uint8_t data[11];
// Size of encoded data.
int size = 0;
// Random parameter value.
float outValue = (float)(rand() % 20);
// Encode command.
VSource::encodeSetParamCommand(data, size, VSourceParam::EXPOSURE, outValue);
```

encodeCommand method of VSource interface class

encodeCommand(...) static method of [VSource](#) interface class designed to encode command for remote video source. To control a video source remotely, the developer has to design his own protocol and according to it encode the command and deliver it over the communication channel. To simplify this, the [VSource](#) class contains static methods for encoding the control command. The [VSource](#) class provides two types of commands: a parameter change command (SET_PARAM) and an action command (COMMAND). **encodeCommand(...)** designed to encode COMMAND (action command). Method declaration:

```
static void encodeCommand(uint8_t* data, int& size, VSourceCommand id);
```

Parameter	Description
data	Pointer to data buffer for encoded command. Must have size >= 11.
size	Size of encoded data. Will be 11 bytes.
id	Command ID according to VSourceCommand enum.

COMMAND format:

Byte	Value	Description
0	0x00	COMMAND header value.
1	Major	Major version of VSource class.
2	Minor	Minor version of VSource class.
3	id	Command ID int32_t in Little-endian format.
4	id	Command ID int32_t in Little-endian format.
5	id	Command ID int32_t in Little-endian format.

Byte	Value	Description
6	id	Command ID <code>int32_t</code> in Little-endian format.

`encodeCommand(...)` is static and used without [VSource](#) class instance. This method used on client side (control system). Command encoding example:

```
// Buffer for encoded data.
uint8_t data[11];
// Size of encoded data.
int size = 0;
// Encode command.
VSource::encodeCommand(data, size, VSourceCommand::RESTART);
```

decodeCommand method of VSource interface class

`decodeCommand(...)` static method of [VSource](#) interface class designed to decode command on video source side (edge device). Method will decode commands which encoded by [encodeCommand\(...\)](#) and [encodeSetParamCommand\(...\)](#) methods of [VSource](#) interface class. Method declaration:

```
static int decodeCommand(uint8_t* data, int size, VSourceParam& paramId, VSourceCommand& commandId, float& value);
```

Parameter	Description
data	Pointer to input command.
size	Size of command. Should be 7 bytes for COMMAND or 11 bytes for SET_PARAM command.
paramId	Parameter ID according to VSourceParam enum. After decoding SET_PARAM command the method will return parameter ID.
commandId	Command ID according to VSourceCommand enum. After decoding COMMAND the method will return command ID.
value	Parameter value (after decoding SET_PARAM command).

Returns: **0** - in case decoding COMMAND, **1** - in case decoding SET_PARAM command or **-1** in case errors.

Data structures

`VSource.h` file of [VSource](#) interface class defines IDs for parameters ([VSourceParam](#) enum) and IDs for action commands ([VSourceCommand](#) enum).

VSourceCommand enum

Enum declaration:

```
enum class VSourceCommand
{
    /// Restart.
    RESTART = 1
};
```

Table 2 - Video source commands description.

Command	Description
RESTART	Not supported by VSourceV4L2 library.

VSourceParam enum

Enum declaration:

```
enum class VSourceParam
{
    /// [read/write] Logging mode. Values: 0 - Disable, 1 - Only file,
    /// 2 - Only terminal, 3 - File and terminal.
    LOG_LEVEL = 1,
    /// [read/write] Frame width. User can set frame width before initialization
    /// or after. Some video source classes may set width automatically.
    WIDTH,
    /// [read/write] Frame height. User can set frame height before
    /// initialization or after. Some video source classes may set height
    /// automatically.
    HEIGHT,
    /// [read/write] Gain mode. Value depends on implementation but it is
    /// recommended to keep default values: 0 - Manual control, 1 - Auto.
    GAIN_MODE,
    /// [read/write] Gain value. Value: 0(min for particular video source class)
    /// - 65535(max for particular video source class).
    GAIN,
    /// [read/write] Exposure mode. Value depends on implementation but it is
    /// recommended to keep default values: 0 - Manual control, 1 - Auto.
    EXPOSURE_MODE,
    /// [read/write] Exposure value. Value: 0(min for particular video source
    /// class) - 65535(max for particular video source class).
    EXPOSURE,
    /// [read/write] Focus mode. Value depends on implementation but it is
    /// recommended to keep default values: 0 - Manual control, 1 - Auto.
    FOCUS_MODE,
    /// [read/write] Focus position. Value: 0(full near) - 65535(full far).
    FOCUS_POS,
    /// [read only] video capture cycle time. **VSource** class sets this value
    /// automatically. This parameter means time interval between two captured
    /// video frame.
```

```

CYCLE_TIME_MKS,
/// [read/write] FPS. User can set frame FPS before initialization or after.
/// Some video source classes may set FPS automatically.
FPS,
/// [read only] Open flag. 0 - not open, 1 - open.
IS_OPEN,
/// Region of interest upper left corner x coordinate.
ROI_X,
/// Region of interest upper left corner y coordinate.
ROI_Y,
/// Region of interest width.
ROI_WIDTH,
/// Region of interest height.
ROI_HEIGHT,
/// [read/write] Custom parameter. Depends on implementation.
CUSTOM_1,
/// [read/write] Custom parameter. Depends on implementation.
CUSTOM_2,
/// [read/write] Custom parameter. Depends on implementation.
CUSTOM_3
};

```

Table 3 - Video source params description. Some params are not supported in **VSourceM4D2** implementation.

Parameter	Access	Description
LOG_LEVEL	read / write	Logging mode. Specifies the log output mode. Values: 0 - Disable, 1 - Only file, 2 - Only terminal (console), 3 - File and terminal.
WIDTH	read only	Frame width. Can't be changes after initialization.
HEIGHT	read only	Frame height. Can't be changes after initialization.
GAIN_MODE	read / write	Gain mode. Values: 0 - Manual control, 1 - Auto. Some V4I2 video source may not support this parameter to control.
GAIN	read / write	Gain value. Value: 0(min) - 65535(max). Some V4I2 video source may not support this parameter to control.
EXPOSURE_MODE	read / write	Exposure mode. Values: 0 - Manual mode, 1 - Auto mode, 2 - Shutter priority, 3 - Aperture priority. Some V4I2 video source may not support this parameter to control.
EXPOSURE	read / write	Exposure value. Value: 0(min) - 65535(max). Some V4I2 video source may not support this parameter to control.
FOCUS_MODE	read / write	Focus mode. Values: 0 - Manual control, 1 - Auto. Some V4I2 video source may not support this parameter to control.

Parameter	Access	Description
FOCUS_POS	read / write	Focus position. Value: 0(full near) - 65535(full far). Some V4I2 video source may not support this parameter to control.
CYCLE_TIME_MKS	read only	Video capture cycle time, microseconds. The library class sets this value automatically. This parameter means time interval between two captured video frame.
FPS	read / write	FPS. Can't be changes after initialization.
IS_OPEN	read only	Open flag. 0 - not open, 1 - open.
ROI_X	read / write	Region of interest top-left corner horizontal coordinate. If ROI set the output frame will have size equal to ROI size.
ROI_Y	read / write	Region of interest top-left corner horizontal coordinate. If ROI set the output frame will have size equal to ROI size.
ROI_WIDTH	read / write	Region of interest width, pixels. If ROI set the output frame will have size equal to ROI size.
ROI_HEIGHT	read / write	Region of interest height, pixels. If ROI set the output frame will have size equal to ROI size.
CUSTOM_1	read / write	Not supported. Can have any value.
CUSTOM_2	read / write	Not supported. Can have any value.
CUSTOM_3	read / write	Not supported. Can have any value.

VSourceParams class description

VSourceParams class declaration

VSourceParams class used for video source initialization ([initVSource\(...\)](#) method) or to get all actual params ([getParams\(...\)](#) method). Also **VSourceParams** provide structure to write/read params from JSON files (**JSON_READABLE** macro, see [ConfigReader](#) class description) and provide methos to encode and decode params. Class declaration:

```
class VSourceParams
{
public:
    /// Logging mode. values: 0 - Disable, 1 - Only file,
    /// 2 - only terminal, 3 - File and terminal.
```

```

int logLevel{0};
// Video source: file, video stream, video device, camera num, etc.
std::string source{"/dev/video0"};
// FOURCC: RGB24, BGR24, YUYV, UYVY, GRAY, YUV24, NV12, NV21, YU12, YV12.
// Value says to video source class which pixel format preferable for
// output video frame. Particular video source class can ignore this params
// during initialization. Parameters should be set before initialization.
std::string fourcc{"YUYV"};
// Frame width. User can set frame width before initialization
// or after. Some video source classes may set width automatically.
int width{1920};
// Frame height. User can set frame height before
// initialization or after. Some video source classes may set height
// automatically.
int height{1080};
// Gain mode. Value depends on implementation but it is
// recommended to keep default values: 0 - Manual control, 1 - Auto.
int gainMode{1};
// Gain value. Value: 0(min for particular video source class)
// - 65535(max for particular video source class).
int gain{0};
// Exposure mode. Value depends on implementation but it is
// recommended to keep default values: 0 - Manual control, 1 - Auto.
int exposureMode{1};
// Exposure value. Value: 0(min for particular video source
// class) - 65535(max for particular video source class).
int exposure{1};
// Focus mode. Focus mode. Value depends on implementation but it is
// recommended to keep default values: 0 - Manual control, 1 - Auto.
int focusMode{1};
// Focus position. Value: 0(full near) - 65535(full far).
int focusPos{0};
// Video capture cycle time. **vSource** class sets this value
// automatically. This parameter means time interval between two captured
// video frame.
int cycleTimeMks{0};
// FPS. User can set frame FPS before initialization or after.
// Some video source classes may set FPS automatically.
float fps{0};
// Open flag. 0 - not open, 1 - open.
bool isOpen{false};
// Region of interest upper left corner x coordinate.
int roiX{0};
// Region of interest upper left corner y coordinate.
int roiY{0};
// Region of interest width.
int roiWidth{0};
// Region of interest height.
int roiHeight{0};
// Custom parameter. Depends on implementation.
float custom1{0.0f};
// Custom parameter. Depends on implementation.
float custom2{0.0f};
// Custom parameter. Depends on implementation.
float custom3{0.0f};

```

```

JSON_READABLE(VSourceParams, LogLevel, source, fourcc, width, height,
              gainMode, exposureMode, focusMode, fps, roiX, roiY,
              roiWidth, roiHeight, custom1, custom2, custom3);

/// Copy operator.
VSourceParams& operator= (const VSourceParams& src);

/// Encode (serialize) params.
bool encode(uint8_t* data, int bufferSize, int& size,
            VSourceParamsMask* mask = nullptr);

/// Decode (deserialize) params.
bool decode(uint8_t* data, int dataSize);
};

```

Table 4 - VSourceParams class fields description.

Field	type	Description
LogLevel	int	Logging mode. Specifies the log output mode. Values: 0 - Disable, 1 - Only file, 2 - Only terminal (console), 3 - File and terminal.
source	string	Full name of video device in Linux OS. Default name format: /dev/video0, /dev/video1 etc. or can be /dev/v4l/by-id/... in case UVC compatible cameras.
fourcc	string	Pixel format. Valid values: BGR24, RGB24, GRAY, YUV24, YUYV, UYVY, NV12, NV21, YV12, YU12. If fourcc not set the library will chose appropriate format according to existing video device parameters. Value says to video source class which pixel format preferable for output video frame.
width	int	Video frame width. Video frame height must be set as well. The library will try set this value in video capture hardware parameters. If set to 0 the library will detect frame width automatically according to existing video device parameters.
height	int	Video frame height. Video frame width must be set as well. The library will try set this value in video capture hardware parameters. If set to 0 the library will detect frame width automatically according to existing video device parameters.
gainMode	int	Gain mode. Values: 0 - Manual control, 1 - Auto. Some V4l2 video source may not support this parameter to control.
gain	int	Gain value. Value: 0(min) - 65535(max). Some V4l2 video source may not support this parameter to control.

Field	type	Description
exposureMode	int	Exposure mode. Values: 0 - Manual mode, 1 - Auto mode, 2 - Shutter priority, 3 - Aperture priority. Some V4l2 video source may not support this parameter to control.
exposure	int	Exposure value. Value: 0(min) - 65535(max). Some V4l2 video source may not support this parameter to control.
focusMode	int	Focus mode. Values: 0 - Manual control, 1 - Auto. Some V4l2 video source may not support this parameter to control.
focusPos	int	Focus position. Value: 0(full near) - 65535(full far). Some V4l2 video source may not support this parameter to control.
cycleTimeMks	int	Video capture cycle time. The library class sets this value automatically. This parameter means time interval between two captured video frame.
fps	float	FPS. User can set frame FPS only before initialization.
isOpen	bool	Open flag. false - not open, true - open.
roiX	int	Region of interest top-left corner horizontal coordinate. If ROI set the output frame will have size equal to ROI size.
roiY	int	Region of interest top-left corner horizontal coordinate. If ROI set the output frame will have size equal to ROI size.
roiWidth	int	Region of interest width, pixels. If ROI set the output frame will have size equal to ROI size.
roiHeight	int	Region of interest height, pixels. If ROI set the output frame will have size equal to ROI size.
custom1	float	Not supported. Can have any value.
custom2	float	Not supported. Can have any value.
custom3	float	Not supported. Can have any value.

None: *VSourceParams* class fields listed in Table 4 reflects params set/get by methods [setParam\(...\)](#) and [getParam\(...\)](#).

Encode video source params

VSourceParams class provides method **encode(...)** to serialize video source params (fields of [VSourceParams](#) class, see Table 4). Serialization of video source params necessary in case when you need to send video source params via communication channels. Method doesn't encode fields: **initString** and **fourcc**. Method provides options to exclude particular parameters from serialization. To do this method inserts binary mask (2 bytes) where each bit represents particular parameter and **decode(...)** method recognizes it. Method declaration:

```
bool encode(uint8_t* data, int bufferSize, int& size, VSourceParamsMask* mask = nullptr);
```


Parameter	Value
data	Pointer to data buffer.
size	Size of encoded data. 78 bytes by default.
bufferSize	Data buffer size. If buffer size smaller than required, buffer will be filled with fewer parameters.
mask	Parameters mask - pointer to VSourceParamsMask structure. VSourceParamsMask (declared in VSource.h file) determines flags for each field (parameter) declared in VSourceParams class. If the user wants to exclude any parameters from serialization, he can put a pointer to the mask. If the user wants to exclude a particular parameter from serialization, he should set the corresponding flag in the VSourceParamsMask structure.

VSourceParamsMask structure declaration:

```

struct VSourceParamsMask
{
    bool logLevel{true};
    bool width{true};
    bool height{true};
    bool gainMode{true};
    bool gain{true};
    bool exposureMode{true};
    bool exposure{true};
    bool focusMode{true};
    bool focusPos{true};
    bool cycleTimeMks{true};
    bool fps{true};
    bool isOpen{true};
    bool roiX{true};
    bool roiY{true};
    bool roiWidth{true};
    bool roiHeight{true};
    bool custom1{true};
    bool custom2{true};
    bool custom3{true};
};

```

Example without parameters mask:

```

// Prepare random params.
VSourceParams in;
in.initString = "alsfghljb";
in.logLevel = 0;

// Encode data.
uint8_t data[1024];
int size = 0;
in.encode(data, 1024, size);
cout << "Encoded data size: " << size << " bytes" << endl;

```

Example without parameters mask:

```
// Prepare random params.
VSourceParams in;
in.initString = "alsfghljb";
in.logLevel = 0;

// Prepare params mask.
VSourceParamsMask mask;
mask.logLevel = false; // Exclude logLevel. Others by default.

// Encode data.
uint8_t data[1024];
int size = 0;
in.encode(data, 1024, size, &mask);
cout << "Encoded data size: " << size << " bytes" << endl;
```

Decode video source params

VSourceParams class provides method **decode(...)** to deserialize video source params (fields of [VSourceParams](#) class, see Table 4). Deserialization of video source params necessary in case when you need to receive video source params via communication channels. Method doesn't decode fields: **initString** and **fourcc**. Method automatically recognizes which parameters were serialized by **encode(...)** method. Method declaration:

```
bool decode(uint8_t* data, int dataSize);
```

Parameter	Value
data	Pointer to encode data buffer. Data size should be at least 62 bytes.
dataSize	Size of data.

Returns: TRUE if data decoded (deserialized) or FALSE if not.

Example:

```
// Encode data.
VSourceParams in;
uint8_t data[1024];
int size = 0;
in.encode(data, 1024, size);

cout << "Encoded data size: " << size << " bytes" << endl;

// Decode data.
VSourceParams out;
if (!out.decode(data, size))
    cout << "Can't decode data" << endl;
```

Read params from JSON file and write to JSON file

VSource library depends on [ConfigReader](#) library which provides method to read params from JSON file and to write params to JSON file. Example of writing and reading params to JSON file:

```
// Write params to file.
VSourceParams in;
cr::utils::ConfigReader inConfig;
inConfig.set(in, "vSourceParams");
inConfig.writeToFile("TestVSourceParams.json");

// Read params from file.
cr::utils::ConfigReader outConfig;
if(!outConfig.readFromFile("TestVSourceParams.json"))
{
    cout << "Can't open config file" << endl;
    return false;
}
```

TestVSourceParams.json will look like:

```
{
  "vSourceParams": {
    "custom1": 150.0,
    "custom2": 252.0,
    "custom3": 30.0,
    "exposureMode": 226,
    "focusMode": 89,
    "fourcc": "skdfjhvk",
    "fps": 206.0,
    "gainMode": 180,
    "height": 61,
    "logLevel": 17,
    "roiHeight": 249,
    "roiWidth": 167,
    "roiX": 39,
    "roiY": 223,
    "source": "alsfghljb",
    "width": 35
  }
}
```

Build and connect to your project

Typical commands to build **VSourceV4L2** library:

```
cd VSourceV4L2
git submodule update --init --recursive
mkdir build
cd build
cmake ..
make
```

If you want connect **VSourceV4L2** library to your CMake project as source code you can make follow. For example, if your repository has structure:

```
CMakeLists.txt
src
  CMakeList.txt
  yourLib.h
  yourLib.cpp
```

Create folder **3rdparty** in your repository. Copy repository folder **VSourceV4L2** to **3rdparty** folder. New structure of your repository:

```
CMakeLists.txt
src
  CMakeList.txt
  yourLib.h
  yourLib.cpp
3rdparty
  VSourceV4L2
```

Create CMakeLists.txt file in **3rdparty** folder. CMakeLists.txt should contain:

```
cmake_minimum_required(VERSION 3.13)

#####
## 3RD-PARTY
## dependencies for the project
#####
project(3rdparty LANGUAGES CXX)

#####
## SETTINGS
## basic 3rd-party settings before use
#####
# To inherit the top-level architecture when the project is used as a submodule.
SET(PARENT ${PARENT}_YOUR_PROJECT_3RDPARTY)
# Disable self-overwriting of parameters inside included subdirectories.
SET(${PARENT}_SUBMODULE_CACHE_OVERWRITE OFF CACHE BOOL "" FORCE)

#####
## CONFIGURATION
## 3rd-party submodules configuration
#####
SET(${PARENT}_SUBMODULE_VSOURCE_V4L2 ON CACHE BOOL "" FORCE)
if (${PARENT}_SUBMODULE_VSOURCE_V4L2)
  SET(${PARENT}_VSOURCE_V4L2 ON CACHE BOOL "" FORCE)
```

```

SET(${PARENT}_VSOURCE_V4L2_TEST                OFF CACHE BOOL "" FORCE)
SET(${PARENT}_VSOURCE_V4L2_EXAMPLE            OFF CACHE BOOL "" FORCE)
endif()

#####
## INCLUDING SUBDIRECTORIES
## Adding subdirectories according to the 3rd-party configuration
#####
if (${PARENT}_SUBMODULE_VSOURCE_V4L2)
    add_subdirectory(VSourceV4L2)
endif()

```

File **3rdparty/CMakeLists.txt** adds folder **VSourceV4L2** to your project and excludes test application (VSourceV4L2 class test applications) from compiling. Your repository new structure will be:

```

CMakeLists.txt
src
  CMakeList.txt
  yourLib.h
  yourLib.cpp
3rdparty
  CMakeLists.txt
  VSourceV4L2

```

Next you need include folder 3rdparty in main **CMakeLists.txt** file of your repository. Add string at the end of your main **CMakeLists.txt**:

```
add_subdirectory(3rdparty)
```

Next you have to include VSourceV4L2 library in your **src/CMakeLists.txt** file:

```
target_link_libraries(${PROJECT_NAME} VSourceV4L2)
```

Done!

Simple example

Example shows how to initialize video source with generic VSource interface and how to capture video in loop. Also example show how to get parameter value (video capture cycle time). Example:

```

#include <iostream>
#include "VSourceV4L2.h"

// Entry point.
int main(void)
{
    // Init video source.
    cr::video::VSource* source = new cr::video::VSourceV4L2();
    std::string initString = "/dev/video0";
    if (!source->openVSource(initString))
        return -1;
}

```

```
// Main loop.
cr::video::Frame frame;
while (true)
{
    // wait new frame 1 sec.
    if (!source->getFrame(frame, 1000))
        continue;

    std::cout << "New frame " << frame.frameId <<
        " (" << frame.width << "x" << frame.height << ") cycle time : " <<
        (int)source->getParam(cr::video::VSourceParam::CYCLE_TIME_MKS) <<
        " mksec" << std::endl;
}

return 1;
}
```