

CANrunner v2.0 User Manual



CANrunner
CAN diagnostic software.

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INTRODUCTION

CANrunner is a CAN diagnostic software tool built with the cross-platform Qt toolkit. It is a powerful tool for software developers and service engineers, providing advanced data monitoring and analysis capabilities. All CANrunner features can be used with both standard CAN and CAN FD protocols.

CANrunner allows users to

- Monitor real time data on CAN bus
- Analyze and catch problems on CAN bus
- View CAN bus statistics
- Send messages to a CAN bus
- Parse CAN protocols like J1939
- Log CAN messages to a file and inspect and parse log files.
- Remotely diagnose CAN bus over Ethernet by connecting to WRM remote device. CANrunner can be used also as a part of Wapice's WRM remote management system.

CANrunner can be used on Windows and Linux. CANrunner is suited to be used with USB to CAN adapters. Supported CAN adapter manufacturers are Kvaser, PEAK-System and HMS IXXAT. These manufacturers are supported on both Windows and Linux and both standard CAN and CAN FD adapters are supported. Remember to install manufacturer specific device drivers before using CAN adapters with CANrunner.

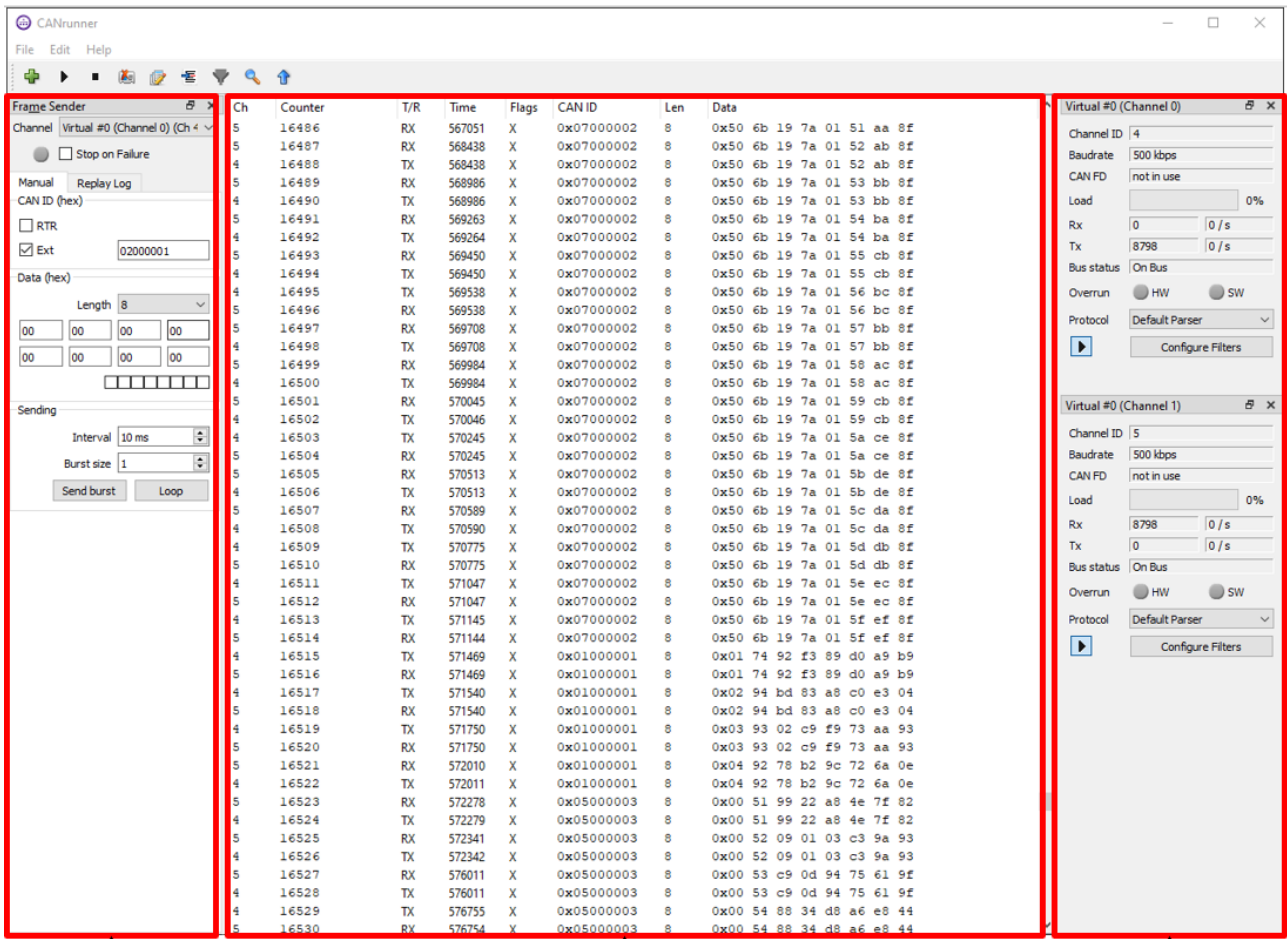
Read more and download the CANrunner software for free at:

www.wapice.com/products/canrunner

1. USER INTERFACE

1.1. Main screen

CANrunner's main screen consists of a traffic monitor, traffic generator panels and channel panels. All panels can be undocked from their default position and placed in desired location.



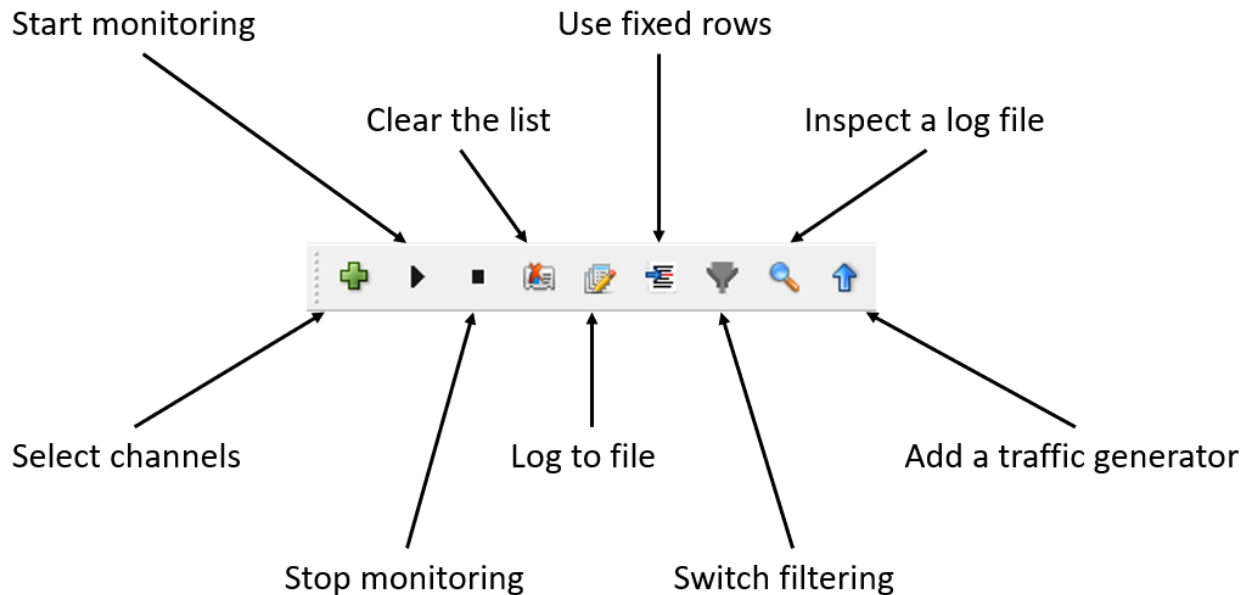
Traffic generator

Traffic monitor

Channel settings

1.2. Toolbar

All toolbar's functionalities can be also accessed from application's menu bar.



Toolbar's buttons:

Select channels – opens the device manager window which allows managing monitored channels.

Start monitoring – starts or continues channels monitoring.

Stop monitoring – halts channels monitoring.

Clear the list – clears traffic monitor.

Log to file – create/open a file to save further CAN messages.

Use fixed rows – switches on/off option of grouping CAN messages by CAN ID.

Switch filtering – switches on/off option of message filtering.

Inspect a log file – opens log inspector in a new window.

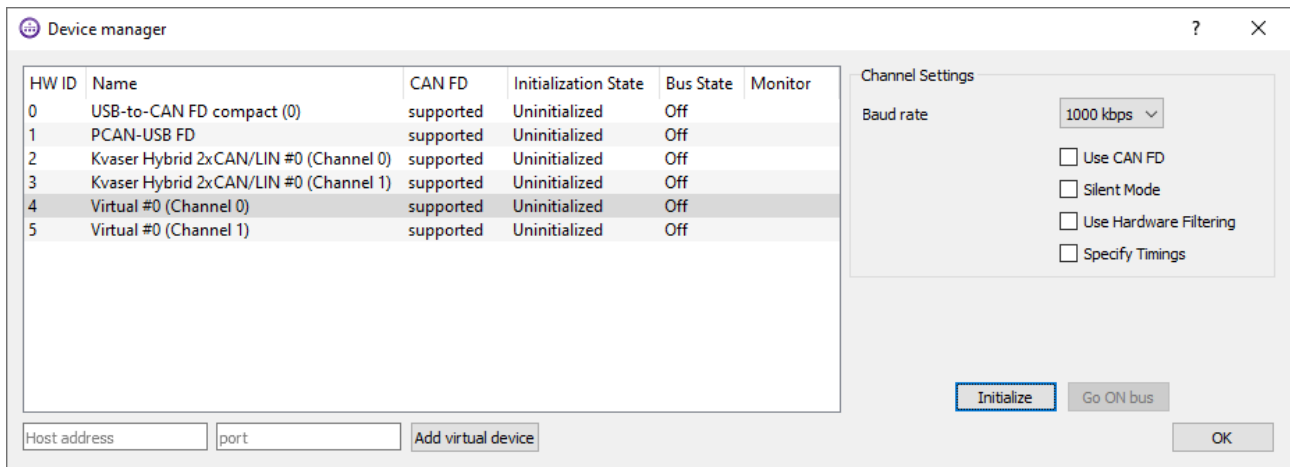
Add a traffic generator – adds new traffic generator.

2. SETTING UP A TRAFFIC MONITOR

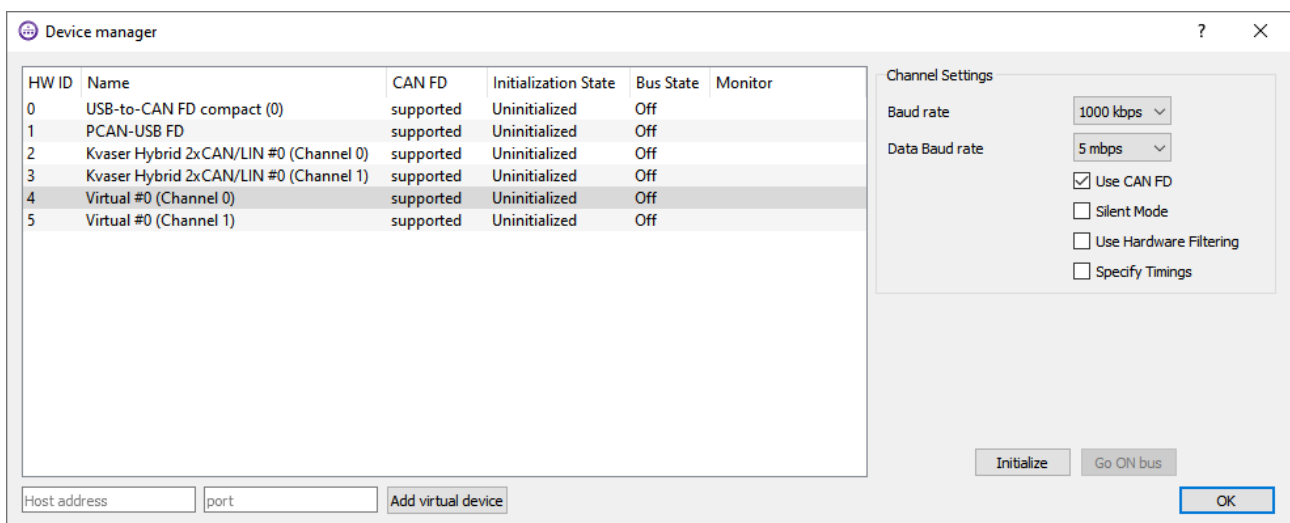
Do the following steps to set up a CAN device:

2.1. Add new channel

- ⤴ Open a device manager by pressing (Select channels to monitor) button.
- ⤴ The device list updates automatically when new supported devices are plugged in.



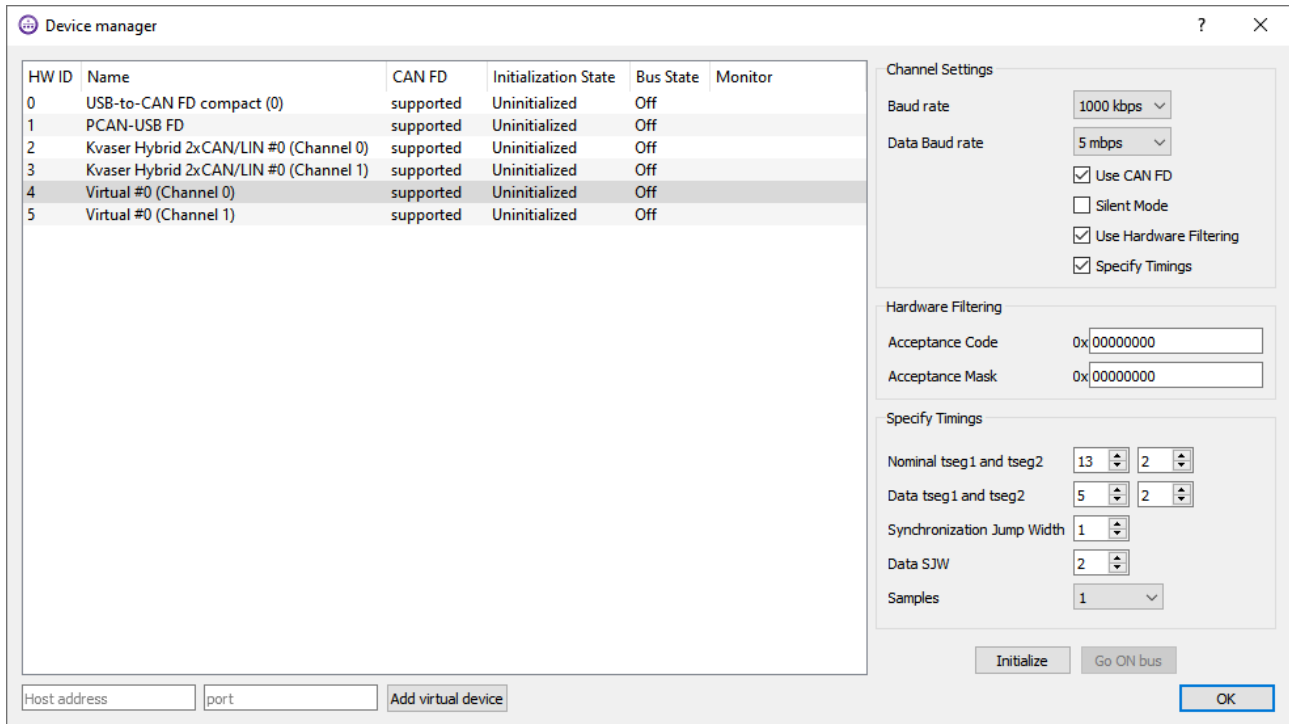
- ⤴ Select the device you want to monitor and select the desired baud rate for the channel.
- ⤴ If you want to use CAN FD and the device supports it check the "Use CAN FD" checkbox and select the desired data baud rate.



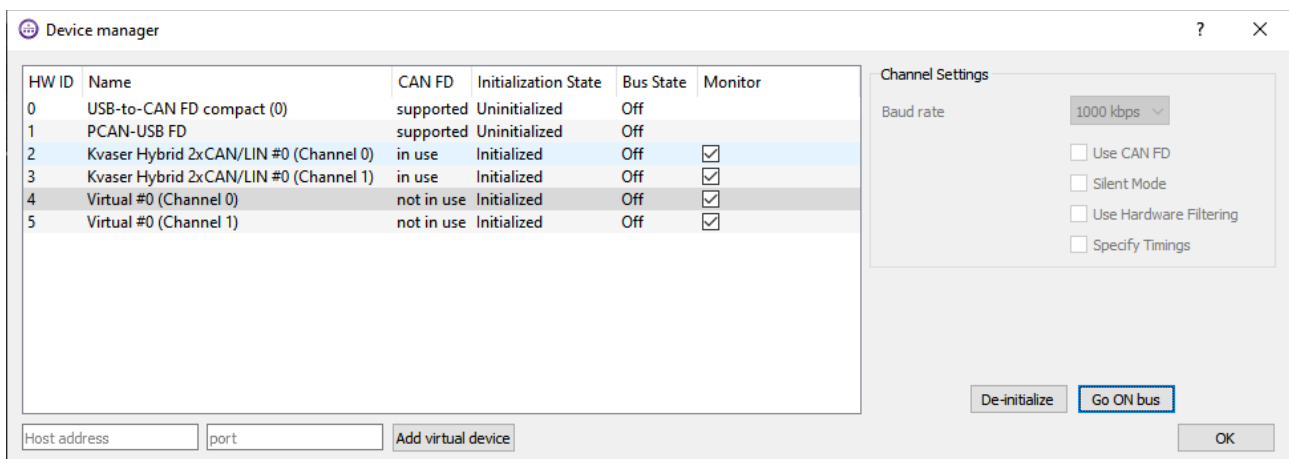
- ⤴ Checking the "Use Hardware Filtering" checkbox opens new options where you can set an acceptance code and an acceptance mask that will be used as a filter in the hardware. The hardware will then discard all CAN messages whose masked CAN ID

does not match the given code.

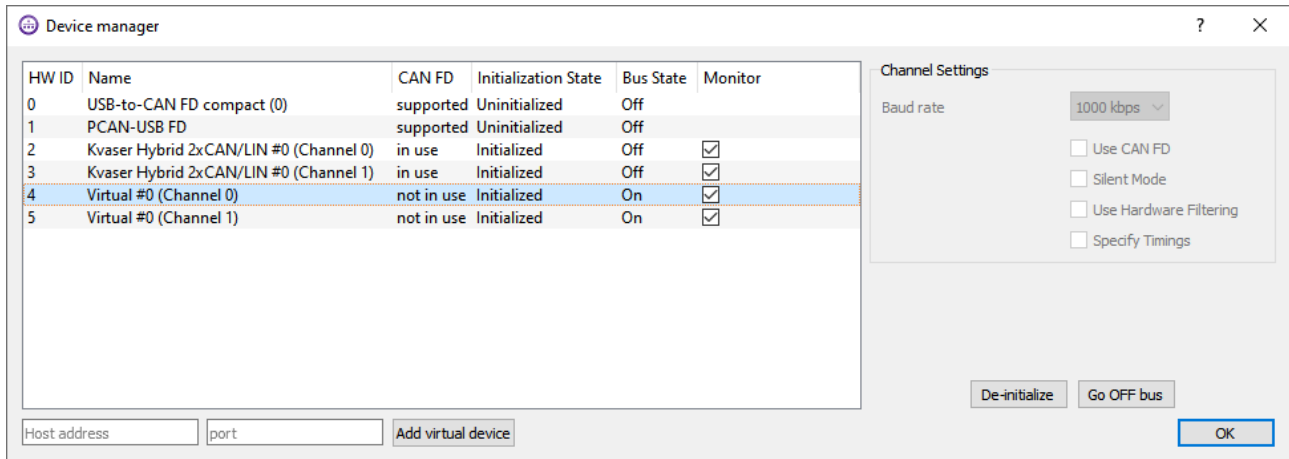
- Checking the "Specify Timings" checkbox opens new options that can be used to initialize the device with specific bit timing parameters. Using the bit timing options is not recommended unless the user is very familiar with CAN bit timings.



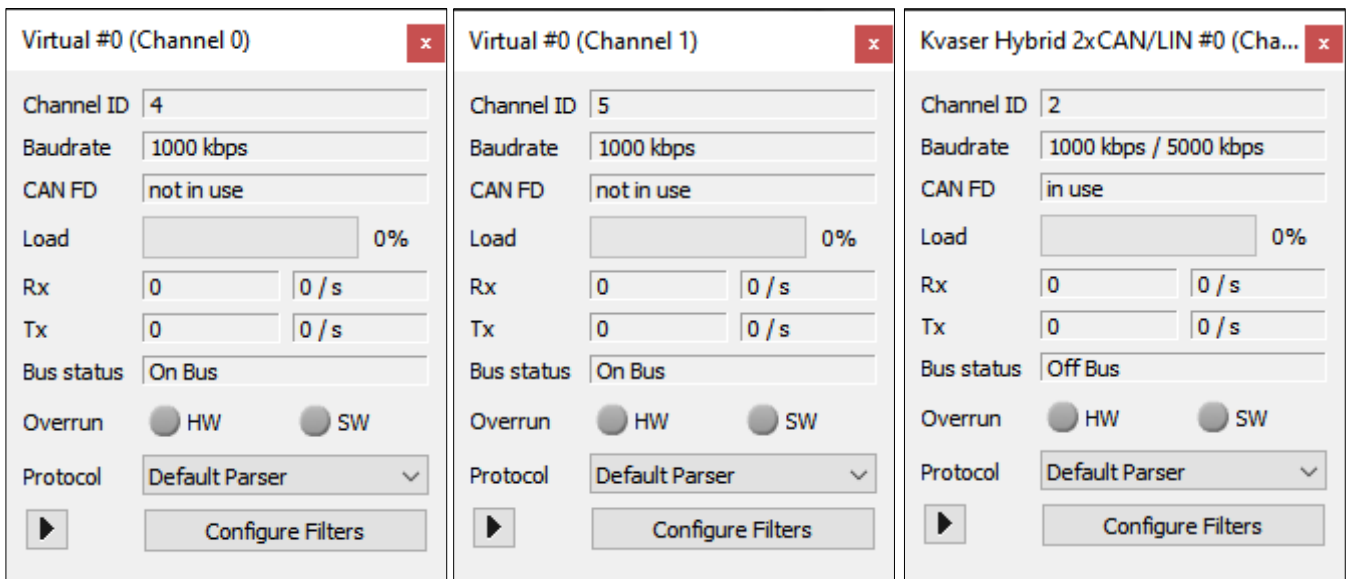
- The "Silent Mode" checkbox sets the device to silent mode. Devices in silent mode only listen to the CAN bus. This means that they do not provide acknowledgement frames to messages placed on the CAN bus.
- The checkbox features do not appear in the channel settings if the device does not support them.
- After setting the desired channel settings press the "Initialize" button. You can initialize many devices at once.




- After initializing devices press the "Go ON bus" button to tell the device to start listening the CAN bus.



- After pressing "OK" button, all monitors of previously initialized channels should be visible on the main screen.



2.2. Start monitoring

- ^ If a channel monitor is not visible on the main screen go back to device manager window and make sure that the "Monitor" field of the channel is checked.
- ^ Press "Start monitoring" button to begin listening on all active channels. Alternatively, you can select/deselect channels to be listened by toggling its  button.

Ch	Counter	T/R	Time	Flags	CAN ID	Len	Data
5	313	RX	18316	X	0x07750001	8	0x01 69 35 d8 9a f2 dc 38
5	314	RX	40644	X	0x07750001	8	0x02 37 85 0c 6d 5a 34 03
5	315	RX	50904	X	0x07750001	8	0x03 09 57 37 c6 2c d9 a0
5	316	RX	61248	X	0x07750001	8	0x04 92 8c a6 7c 3d 03 03
5	317	RX	72974	X	0x07750001	8	0x05 aa 44 cc 09 34 9c 09
5	318	RX	84933	X	0x07750001	8	0x06 dd 88 30 c0 52 30 46
5	319	RX	106736	X	0x07760001	8	0x01 74 02 3c 8d 9a 09 44
5	320	RX	118583	X	0x07760001	8	0x02 00 83 67 80 35 45 01
5	321	RX	129232	X	0x07760001	8	0x03 04 88 86 58 ff ff ff

The traffic monitor's "Flags" column shows CAN frame flags that are set to '1' in the corresponding CAN message.

Standard CAN flags:

- X** – Identifier extension flag, CAN ID is in extended 29-bit format
- R** – Remote transmission request (RTR) flag
- E** – Error flag, the message is an error frame

CAN FD flags:

- B** – Bit Rate Switch (BRS) flag, the CAN FD frame uses higher bit rate for the frame's data part
- e** – Error Status Indicator (ESI) flag, the transmitter is in error passive mode

3. TRAFFIC GENERATOR

The CANrunner has a feature of generating messages on the channels with user-defined frame settings, CAN ID and data bytes. Traffic can be optionally generated in adjustable intervals.

3.1. Generate traffic

- ⤴ To send CAN messages to the CAN bus open a traffic generator by pressing the "Add a new traffic generator" button in the toolbar. This opens a tool-view labeled "Frame Sender".
- ⤴ The Frame Sender has options that can be used to define a CAN message's id, flags and data. At top of the Frame Sender you can choose a channel through which you want to send CAN messages. If the chosen channel is initialized with CAN FD, then there will be more flag and data length options.
- ⤴ To send a message fill in the data and press the "Send burst" button. This will send "Burst size" amount of messages to the chosen channel's CAN bus. Pressing the "Loop" button will continuously send messages with the set interval.

Frame Sender
x

Channel Virtual #0 (Channel 0) (Ch 4 v)

Stop on Failure

Manual Replay Log

CAN ID (hex)

RTR

Ext 00772001

Data (hex)

Length 8

0A	01	04	92
58	A3	4D	FF

Sending

Interval 10 ms

Burst size 1

Send burst Loop

Frame Sender
x

Channel Kvaser Hybrid 2xCAN/LIN # v

Stop on Failure

Manual Replay Log

CAN ID (hex)

RTR BRS

Ext 00772001

Data (hex)

Length 64

1B	01	3A	93
7C	83	CA	89
03	89	40	20
7D	A8	3B	07
3B	A0	49	6F
E9	37	EA	84
05	70	05	39
00	83	7F	03
93	27	50	83
02	9A	04	8F
6E	48	8B	83
CC	9D	60	39
7D	43	47	59
36	00	50	36
29	0C	04	03
83	FF	FF	FF

Sending

Interval 10 ms

Burst size 1

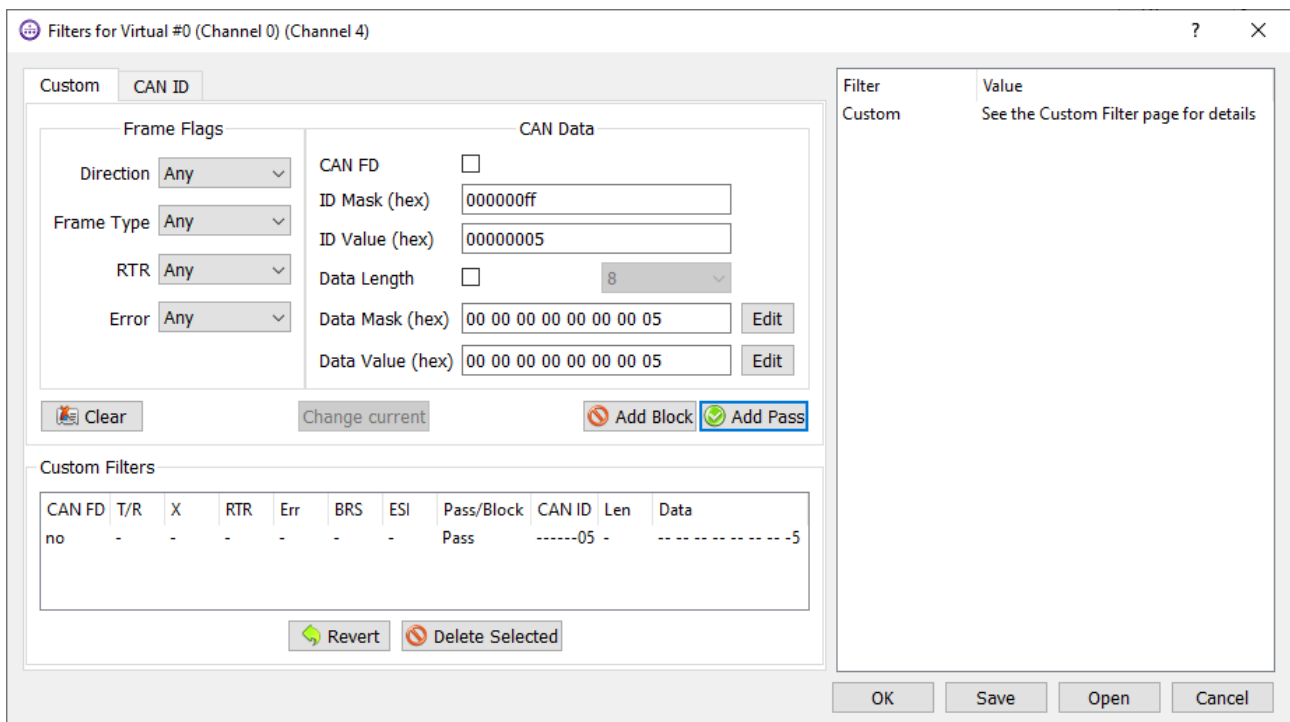
Send burst Loop

4. FILTERING

To add a channel filter to the traffic monitor, open the filter manager by pressing "Configure filters" button on the desired channel's panel in the main window. Two types of filtering are available: custom filter and CAN ID filter.

4.1. Custom filter

Using this filter, you can set a message filtering according to their flag settings, data and CAN ID. Checking the CAN FD checkbox opens new CAN FD specific flag options and extends the data length options. Clicking the "Edit" button next to the Data Mask/Value opens a new window in which it is easier to input specific data mask and value.



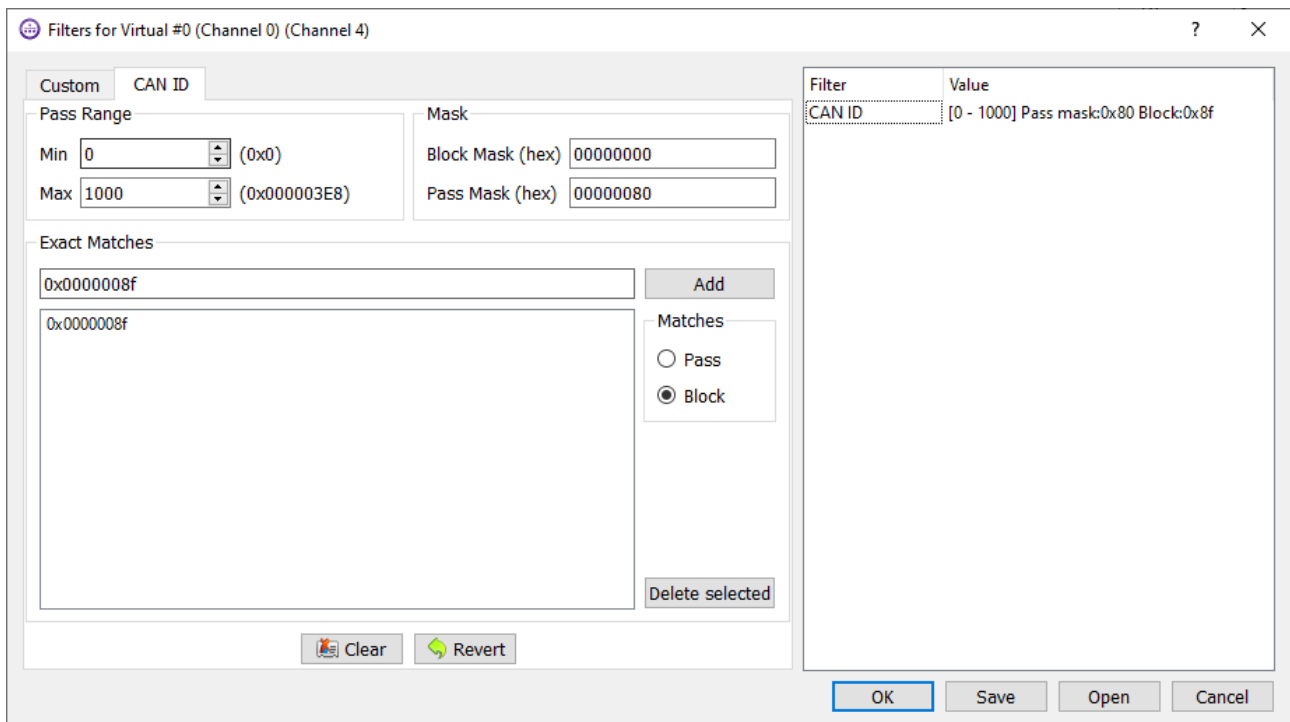
CAN FD	T/R	X	RTR	Err	BRS	ESI	Pass/Block	CAN ID	Len	Data
no	-	-	-	-	-	-	Pass	-----05	-	-----5

By using the ID mask, you can specify which bits of ID value you want to filter. Leaving a certain mask bit on value 0 will pass/block message without filtering it, whereas, setting bit to 1 will force comparison to specified ID value bit. Data mask and value can be set in similar manner. For instance, in the picture above filter passes all messages that have the last CAN ID byte equal to 0x05, but also only those which eight data byte's fifth bit is set to 1.

4.2. CAN ID filter

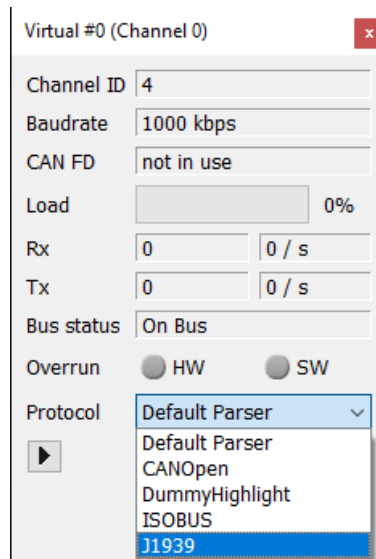
Using this filter, you can pass or block messages with whole range of CAN IDs and add single exceptions to it. Similarly to custom filter, pass and block mask can be used too.

In the following example only messages with CAN ID in range from 0 to 1000 are accepted. In addition, pass mask narrows the range to only those IDs which eighth bit is set to 1. Finally one exception was added which blocks messages with ID equals to 0x8F.

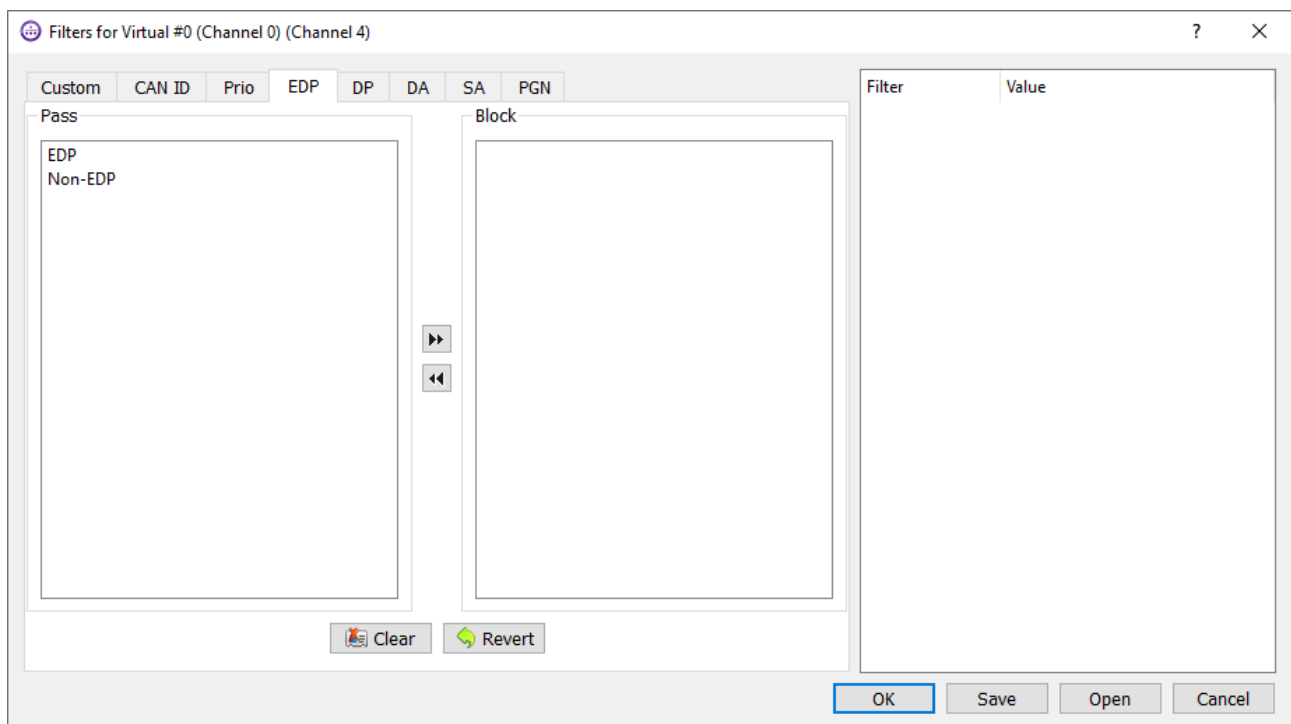


5. CUSTOM PROTOCOL PARSERS

CANrunner supports custom protocol parsers. To change parser for a channel pick it from "Protocol" drop-down list on the channel panel:



After choosing different protocol parser, columns required to present the protocol's frame will be added to the traffic monitor. Furthermore, new filtering options (tabs) will be added in the channel's filter manager, if they were defined for chosen parser:



5.1. Building custom protocol parsers

CANrunner provides the option to add custom protocol parser plugins with own channel filters by using CANMediaMsg struct from CANMediaMsg.h file and by implementing IWCanParser interface from IWCanParser.h file. Both required files are located in the "include" folder at the CANrunner's main directory.

A custom parser plugin should be copied to "bin/parsers/" directory before starting the CANrunner application.

5.2. Using the J1939 protocol parser

CANrunner offers a possibility to parse SAE J1939 protocol messages more thoroughly. To use this feature follow the steps below:

- ⤴ Initialize a channel and set the protocol parser to J1939 from the channel panel's drop-down list.
- ⤴ Receive or generate the J1939 message you wish to parse.
- ⤴ Then double click on the message in the traffic monitor. Double clicking opens a new window which shows the parsed data of the message.

Ch	Counter	T/R	Time	Flags	CAN ID	Len	Data	Prio	EDP	DP	PF	PS	DA	SA	PGN	PGN Label
5	14	RX	0	X	0x00cf00401	8	0xff ff 82 df 1a ff ff ff ff	3	0	0	0xf0	0x04	0x00	0x01	0x0f004	Electronic Engine Controller 1
5	15	RX	14698	X											0x0e000	Cab Message 1
5	16	RX	42955	X											0x0d000	Cab Illumination Message
5	17	RX	50898	X											0x0c000	Proprietarily Configurable Me...
5	18	RX	56243	X											0x0b000	Configuration Identification ...
5	19	RX	59641	X											0x0a000	NTE Status
5	20	RX	63878	X											0x09000	Supplemental Fan Command
5	21	RX	67378	X											0x08000	Hybrid System Control 1
5	22	RX	70773	X											0x07000	Authentication Server to Aut...

PGN: 61444 - Electronic Engine Controller 1

Message Data

SPN Type	SPN Name	Resolution	Data
Measured	Engine Torque Mode	Not available	
Measured	Actual Engine - Percent Torque (Fractional)	Not available	
Measured	Driver's Demand Engine - Percent Torque	Not available	
Measured	Actual Engine - Percent Torque	value	5 %
Measured	Engine Speed	value	859.875 rpm
Status	Source Address of Controlling Device for Engine Control	Not available	
Status	Engine Starter Mode	Not available	
Measured	Engine Demand - Percent Torque	Not available	

- ⤴ J1939 transport protocol messages can also be parsed in the same way.

Ch	Counter	T/R	Time	Flags	CAN ID	Len	Data	Prio	EDP	DP	PF	PS	DA	SA	PGN	PGN Label
5	377	RX	0	X	0x00ec6611	8	0x10 0d 00 02 ff ab fb 00 00	0	0	0	0xec	0x66	0x66	0x11	0x0ec00	Transport Protocol - Connection Mgmt
5	378	RX	1232	X	0x00ec1166	8	0x11 02 01 ff ff ab fb 00 00	0	0	0	0xec	0x11	0x11	0x66	0x0ec00	Transport Protocol - Connection Mgmt
5	379	RX	2732	X	0x00eb6611	8	0x01 5a 00 42 00 0c 00 13	0	0	0	0xeb	0x66	0x66	0x11	0x0eb00	Transport Protocol - Data Transfer
5	380	RX	4076	X	0x00eb6611	8	0x02 00 9e 00 ff ff 0a 32	0	0	0	0xeb	0x66	0x66	0x11	0x0eb00	Transport Protocol - Data Transfer
5	381	RX	6755	X	0x00ec1166	8	0x13 0d 00 02 ff ab fb 00 00	0	0	0	0xec	0x11	0x11	0x66	0x0ec00	Transport Protocol - Connection Mgmt
5	382	RX	15612	X												Transport Protocol - Connection Mgmt
5	383	RX	16013	X												Transport Protocol - Connection Mgmt
5	384	RX	16702	X												Transport Protocol - Data Transfer
5	385	RX	19037	X												Transport Protocol - Data Transfer
5	386	RX	21094	X												Transport Protocol - Data Transfer
5	387	RX	23576	X												Transport Protocol - Data Transfer
5	388	RX	25901	X												Transport Protocol - Data Transfer
5	389	RX	27963	X												Transport Protocol - Data Transfer
5	390	RX	29705	X												Transport Protocol - Connection Mgmt
5	391	RX	31139	X												Transport Protocol - Data Transfer
5	392	RX	31372	X												Transport Protocol - Data Transfer
5	393	RX	33073	X												Transport Protocol - Data Transfer
5	394	RX	35155	X												Transport Protocol - Data Transfer
5	395	RX	36904	X												Transport Protocol - Connection Mgmt
5	396	RX	38406	X												Transport Protocol - Data Transfer
5	397	RX	39936	X												Transport Protocol - Connection Mgmt
5	398	RX	41598	X												Transport Protocol - Data Transfer
5	399	RX	43450	X												Transport Protocol - Data Transfer

PGN: 64427 - DC/AC Accessory Inverter 4 Configuration 1

Frame Info

Name	Message size	Packets	Limit	PGN	PGN name
TP.CM Request To Send	13	2	unlimited	64427	DC/AC Accessory Inverter 4 Configuration 1

Message Data

SPN Type	SPN Name	Resolution	Data
Measured	DC/AC Accessory Inverter 4 DC Side Voltage Minimum Limit Setting	value	4.5 V
Measured	DC/AC Accessory Inverter 4 DC Side Current Maximum Limit Setting	value	3.3 A
Measured	DC/AC Accessory Inverter 4 AC Side RMS Voltage Maximum Limit Setting	value	0.375 Vrms
Measured	DC/AC Accessory Inverter 4 AC Side RMS Current Maximum Limit Setting	value	0.59375 Arms
Measured	DC/AC Accessory Inverter 4 DC Side Voltage Maximum Limit Setting	value	7.9 V
Measured	DC/AC Accessory Inverter 4 DC Side Current Minimum Limit Setting	Not available	
Measured	DC/AC Accessory Inverter 4 AC Side Default Frequency Command Setting	value	10 Hz

▲ CANrunner can also recognize incomplete transport protocol messages.

Ch	Counter	T/R	Time	Flags	CAN ID	Len	Data	Prio	EDP	DP	PF	PS	DA	SA	PGN	PGN Label
5	404	RX	0	X	0x00ec6611	8	0x10 69 00 0f 0f b4 fb 00 00	0	0	0	0xec	0x66	0x66	0x11	0x0ec00	Transport Protocol - Connection Mgmt
5	405	RX	168	X												Transport Protocol - Connection Mgmt
5	406	RX	342	X												Transport Protocol - Data Transfer
5	407	RX	499	X												Transport Protocol - Data Transfer
5	408	RX	683	X												Transport Protocol - Data Transfer
5	409	RX	862	X												Transport Protocol - Data Transfer
5	410	RX	1029	X												Transport Protocol - Data Transfer
5	411	RX	1196	X												Transport Protocol - Connection Mgmt
5	412	RX	1367	X												Transport Protocol - Data Transfer
5	413	RX	1559	X												Transport Protocol - Data Transfer
5	414	RX	1743	X												Transport Protocol - Data Transfer
5	415	RX	1903	X												Transport Protocol - Data Transfer
5	416	RX	2076	X												Transport Protocol - Data Transfer

PGN: 60416 - Transport Protocol - Connection Mgmt

Frame Info

Name	Message size	Packets	Limit	PGN	PGN name
TP.CM Request To Send	105	15	15	64436	Well Stimulation Pump Serial Number

Message Data


Error

Could not find all the Data Transfer frames indicated by this frame

6. CAN MESSAGE LOGGING

CANrunner supports logging CAN messages, inspecting logged CAN messages and sending logged CAN messages to CAN bus.

6.1. Logging CAN messages

- ⤴ To log CAN messages, initialize a channel and press the "Log to file" button in the toolbar.
- ⤴ Pressing the "Log to file" opens a new window where you can choose a name and where to save the log file. After choosing the name and location CANrunner starts to write new messages in the traffic monitor to the log file.
- ⤴ While logging is active the "Log to file" button appears pressed . You can stop logging by pressing the "Log to file" button again.

6.2. Inspecting CANrunner logs

Log inspection is a feature in CANrunner. It can be used for easy examination of log files. The log inspector can open CANrunner log files and parse and filter its messages. Even the extended features of the J1939 protocol parser can be used in log inspector.

- ⤴ To open log inspector, press the "Inspect a log file" button in the toolbar.
- ⤴ In the new window that opens press the "Select" button to select a log file to read.
- ⤴ After selecting a log file CANrunner loads the logged CAN messages to the log inspector window. To parse and filter the messages use the dropdown and button on the left side of the log inspector window.

Log Inspector

Log File: ...CANrunnerLog.log

Select

Parsers & Filters

Select parser: Default Parser

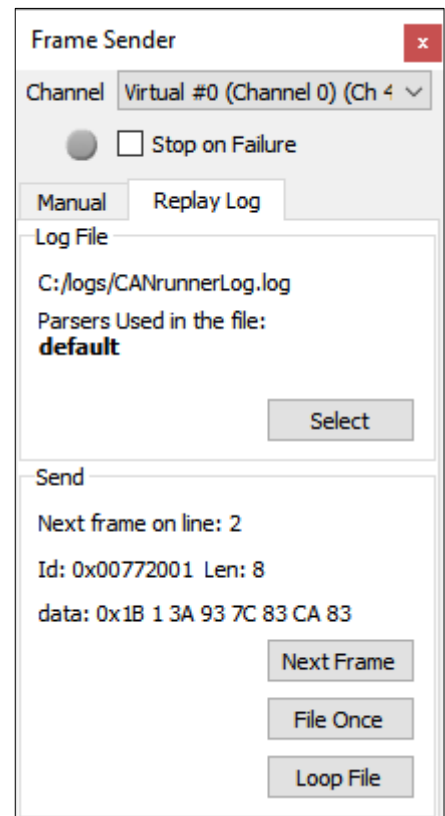
Configure filters

Ch	Counter	T/R	Time	Flags	CAN ID	Len	Data
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 51 aa 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 52 ab 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 53 bb 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 54 ba 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 55 cb 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 56 bc 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 57 bb 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 58 ac 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 59 cb 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 5a ce 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 5b de 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 5c da 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 5d db 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 5e ec 8f
4	2442	TX	685463750	X	0x07000002	8	0x50 6b 19 7a 01 5f ef 8f
4	2442	TX	685463750	X	0x01000001	8	0x01 74 92 f3 89 d0 a9 b9
4	2442	TX	685463750	X	0x01000001	8	0x02 94 bd 83 a8 c0 e3 04
4	2442	TX	685463750	X	0x01000001	8	0x03 93 02 c9 f9 73 aa 93
4	2442	TX	685463750	X	0x01000001	8	0x04 92 78 b2 9c 72 6a 0e
4	2442	TX	685463750	X	0x05000003	8	0x00 51 99 22 a8 4e 7f 82
4	2442	TX	685463750	X	0x05000003	8	0x00 52 09 01 03 c3 9a 93
4	2442	TX	685463750	X	0x05000003	8	0x00 53 c9 0d 94 75 61 9f
4	2442	TX	685463750	X	0x05000003	8	0x00 54 88 34 d8 a6 e8 44
4	2442	TX	685463750	X	0x05000003	8	0x00 55 93 77 da 52 ef ff

6.3. Sending logged CAN messages

CANrunner can generate traffic to a channel's CAN bus from CANrunner log files.

- ⤴ To send CAN messages from a log file switch to the "Replay Log" tab of the Frame Sender.
- ⤴ Select a log file with the "Select" button.
- ⤴ The log file can be sent frame by frame by pressing the "Next Frame" button.
- ⤴ The log can also be looped through using the "File Once" or "Loop File" buttons. Both loop buttons send the messages with intervals indicated by the message's time stamp in the log file. Precise accuracy of the intervals is not guaranteed.



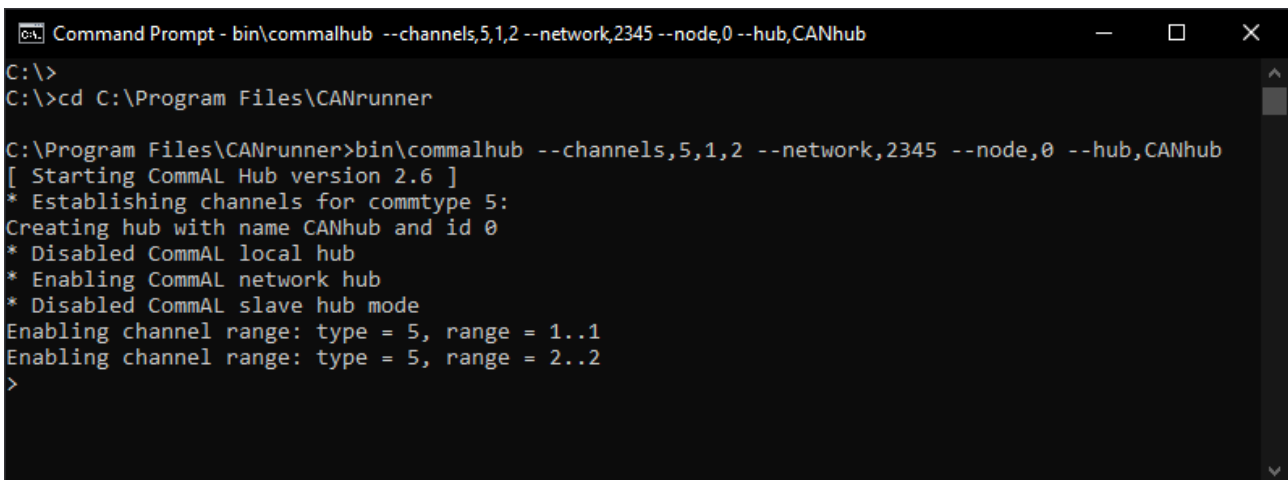
7. SENDING CAN MESSAGES OVER ETHERNET

CANrunner supports sending and receiving CAN messages over ethernet using CommAL. Messages can be sent from CANrunner to CANrunner or CANrunner can be used as remote diagnosis tool by connecting to Wapice's WRM remote device. Read more about Wapice's WRM device on www.wapice.com/products/wrm247.

7.1. Setting up CommAL hub

To send and receive messages over ethernet CANrunner needs to be connected to a CommAL hub. A command line CommAL hub app comes with the CANrunner installation. This hub app can be used in CANrunner to CANrunner communication. To set up the hub follow these steps:

- ✦ Open a command line (Command Prompt on Windows, Terminal on Linux).
- ✦ Move to CANrunner installation folder (for example `cd C:\Program Files\CANrunner`).
- ✦ run the following command on the command line:
`bin\commalhub --channels,5,1,2 --network,2345 --node,0 --hub,CANhub`

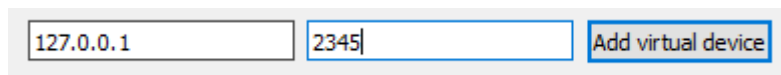


```
Command Prompt - bin\commalhub --channels,5,1,2 --network,2345 --node,0 --hub,CANhub
C:\>
C:\>cd C:\Program Files\CANrunner
C:\Program Files\CANrunner>bin\commalhub --channels,5,1,2 --network,2345 --node,0 --hub,CANhub
[ Starting CommAL Hub version 2.6 ]
* Establishing channels for commtype 5:
Creating hub with name CANhub and id 0
* Disabled CommAL local hub
* Enabling CommAL network hub
* Disabled CommAL slave hub mode
Enabling channel range: type = 5, range = 1..1
Enabling channel range: type = 5, range = 2..2
>
```

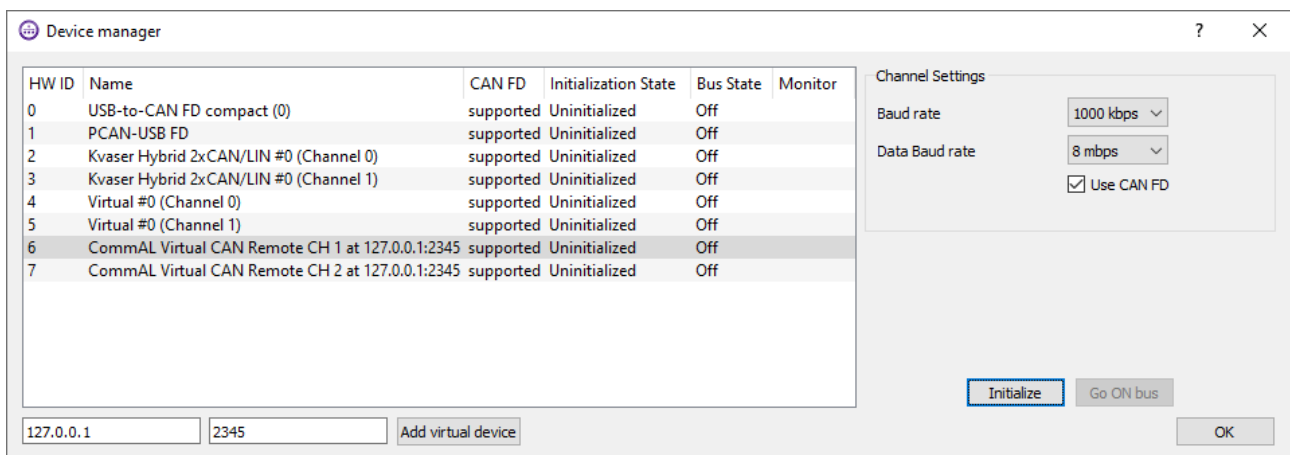
- ✦ the command opens a CommAL network hub on port 2345 that has two CAN FD channels.
- ✦ To initialize the hub with standard CAN channels, use the option "--channels,2,1,2" instead of "--channels,5,1,2".
- ✦ For more info on CommAL hub commands run: `commalhub --help`

7.2. Connecting CANrunner to CommAL hub

- ✦ To connect CANrunner to CommAL hub open CANrunner's device manager.
- ✦ In the lower part of the window there are two text fields and "Add virtual device" button. Type the host computer's IP address to the "Host address" field and the port defined in the CommAL hub to the "port" field. Then press the "Add virtual device" button.



- ✦ After pressing the button CommAL virtual channels should become visible in the device manager.



HW ID	Name	CAN FD	Initialization State	Bus State	Monitor
0	USB-to-CAN FD compact (0)	supported	Uninitialized	Off	
1	PCAN-USB FD	supported	Uninitialized	Off	
2	Kvaser Hybrid 2xCAN/LIN #0 (Channel 0)	supported	Uninitialized	Off	
3	Kvaser Hybrid 2xCAN/LIN #0 (Channel 1)	supported	Uninitialized	Off	
4	Virtual #0 (Channel 0)	supported	Uninitialized	Off	
5	Virtual #0 (Channel 1)	supported	Uninitialized	Off	
6	CommAL Virtual CAN Remote CH 1 at 127.0.0.1:2345	supported	Uninitialized	Off	
7	CommAL Virtual CAN Remote CH 2 at 127.0.0.1:2345	supported	Uninitialized	Off	

- ✦ CommAL virtual channels can be initialized and used in the same way as other CAN channels.

8. CONTACT INFORMATION

In any questions and needs, please contact:

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www.wapice.com