CanOEs - CAN Communication GUI

User Manual

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1. Introduction

CanOEs (CAN Open Environment Software) is a graphical user interface for CAN and CAN FD communication using Vector VN1640A hardware. It provides an intuitive way to send, receive, filter, and analyze CAN messages.

Key Features:

- CAN Classic (up to 8 bytes) and CAN FD (up to 64 bytes) support
- Standard (11-bit) and Extended (29-bit) ID support
- Message filtering by ID, range, or mask
- Periodic message transmission
- Message history and predefined messages
- Dark/Light theme support
- Export logs to TXT file

2. Requirements

Hardware:

- Vector VN1640A CAN interface (or compatible VN16xx device)

Software:

- Windows operating system
- Vector XL Driver Library (vxlapi64.dll)
- Python 3.8 or higher
- Required Python packages:
- `tkinter` (usually included with Python)

3. Getting Started

1. **Connect Hardware**: Connect your Vector VN1640A to the computer via USB
2. **Install Drivers**: Ensure Vector drivers are installed
3. **Run Application**: Execute `python can_gui.py`

4. **Select Channel**: Choose the CAN channel (1-4)
5. **Select Mode**: Choose CAN or CAN FD mode
6. **Connect**: Click the "Connect" button

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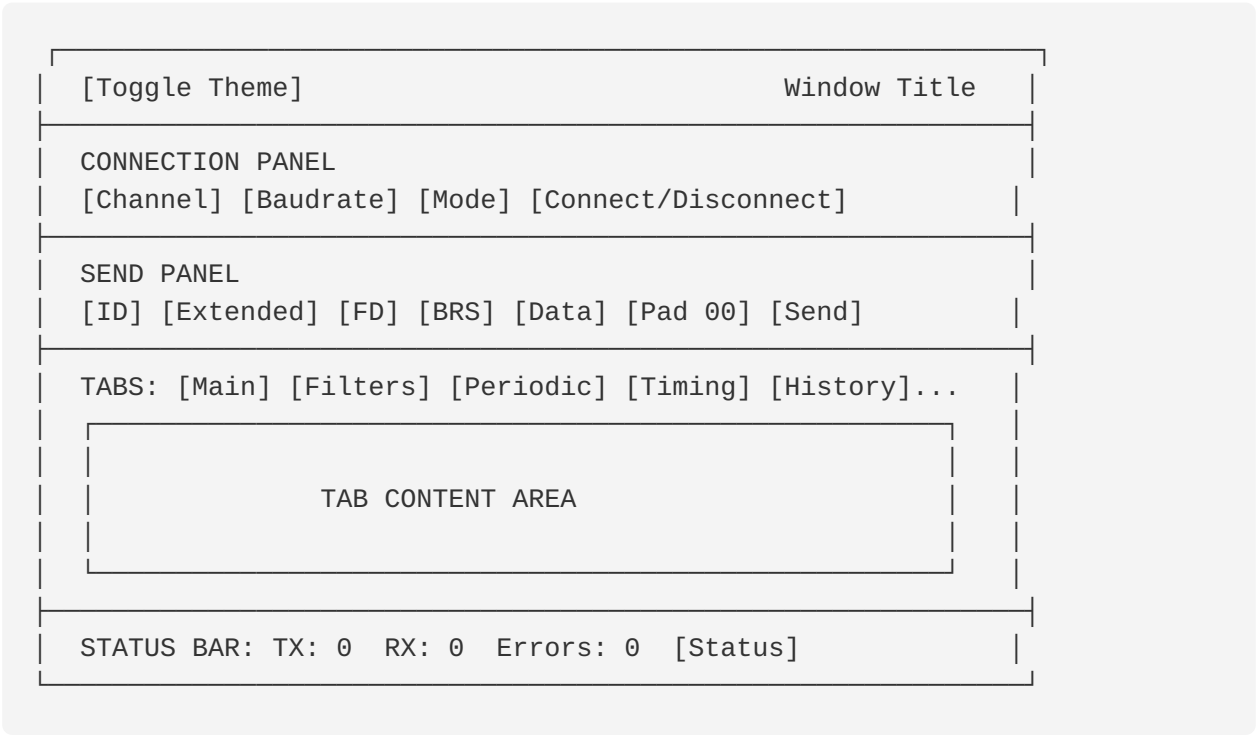
4. Main Interface Overview

The application window is divided into several sections:



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5. Connection Panel

Located at the top of the window, this panel controls the connection to the CAN hardware.

Controls:

Control	Description
Channel	Dropdown to select CAN channel (1, 2, 3, or 4). Corresponds to physical channels on VN1640A.
Baudrate	CAN bus speed selection: 125k, 250k, 500k, 1M bit/s
FD Baudrate	Data phase baudrate for CAN FD: 1M, 2M, 4M, 5M, 8M bit/s

Control	Description
CAN FD Checkbox	Enable CAN FD mode (allows up to 64 bytes per message)
Connect Button	Establishes connection to selected channel. Changes to "Disconnect" when connected.

Connection Status:

- **Disconnected**: Gray status, "Connect" button visible
- **Connected**: Green status, "Disconnect" button visible
- **Error**: Red status with error message

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6. Send Panel

This panel allows you to compose and send CAN messages.

Controls:

Control	Description
ID (hex)	Message ID in hexadecimal (e.g., `123`, `7DF`, `18DA00F1`)
Extended ID	Checkbox - enable for 29-bit extended CAN ID
FD	Checkbox - send as CAN FD frame (allows more than 8 bytes)
BRS	Checkbox - Bit Rate Switch (faster data phase in CAN FD)
Data (hex)	Message payload in hexadecimal, space-separated (e.g., `01 02 03 04`)
Byte Counter	Shows current/maximum bytes (e.g., `8/8 bytes` or `8/64 bytes` for FD)
Pad 00	Button - fills remaining bytes with zeros (to 8 for CAN, 64 for CAN FD)
Send	Button - transmits the message

Data Length Validation:

- **CAN Classic**: Maximum 8 bytes

- **CAN FD**: Maximum 64 bytes
- Counter turns **red** if data exceeds the limit
- Message will not be sent if data is too long

Examples:

Standard CAN message: - ID: `123` - Extended ID: ☐ (unchecked) - FD: ☐ (unchecked) - Data: `01 02 03 04 05 06 07 08`

CAN FD message with BRS: - ID: `456` - Extended ID: ☐ (unchecked) - FD: ☑️ (checked) - BRS: ☑️ (checked) - Data: `01 02 03` → Click "Pad 00" → `01 02 03 00 00 00 ... 00` (64 bytes)

Extended ID message: - ID: `18DA00F1` - Extended ID: ☑️ (checked) - Data: `02 10 01`

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7. Received Messages Panel

Located in the Main tab, this panel displays all received and transmitted CAN messages.

Toolbar Buttons:

Button	Description
▶ Start / 🔲 Stop	Start or stop receiving messages
Clear	Clear all messages from the list
Export TXT	Save message log to a text file
Auto-scroll	Checkbox - automatically scroll to newest message
Show Time	Checkbox - display timestamp column
Show ASCII	Checkbox - display ASCII representation of data
Color Messages	Checkbox - enable/disable color coding of messages (TX=green, RX=blue, DIAG=orange)
Edit Comments	Open dialog to add/edit comments for message IDs

Message List Columns:

Column	Description
Time	Timestamp when message was sent/received
Dir	Direction: TX (transmitted) or RX (received)
ID	Message ID in hexadecimal
DLC	Data Length Code (number of data bytes)
Data	Message payload in hexadecimal
ASCII	ASCII representation of data (if enabled)
Flags	Message flags: EXT (extended), FD, BRS
Comment	User-defined comment for this ID

Message Colors:

Color	Meaning
Green	TX - Transmitted messages
Blue	RX - Received messages
Orange	DIAG - Diagnostic messages (known diagnostic IDs)
Red	ERR - Error frames

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8. Tabs Overview

8.1 Main Tab

The primary workspace containing: - Received Messages panel with message list - Real-time message display - Message filtering based on active filters

8.2 Filters Tab

Create and manage message filters to show or hide specific CAN IDs.

Filter Types:

Type	Description	Example
Single	Match exact ID	ID = `0x123`
Range	Match ID within range	From `0x100` to `0x1FF`
Mask	Match IDs using bit mask	Base `0x700`, Mask `0x7F0` matches `0x700-0x70F`

Filter Controls:

Control	Description
Filter Name	User-friendly name for the filter
Filter Type	Single, Range, or Mask
Accept/Reject	Accept = show matching, Reject = hide matching
Enabled	Checkbox to enable/disable filter
Add Filter	Create new filter
Remove Selected	Delete selected filter
Enable All / Disable All	Batch enable/disable all filters

8.3 Periodic Tab

Configure messages to be sent automatically at regular intervals.

Periodic Message Settings:

Setting	Description
ID	Message ID (hex)
Data	Message payload (hex)
Interval	Time between sends in milliseconds
Count	Number of times to send (0 = infinite)

Setting	Description
Extended/FD/BRS	Message flags

Controls:

Button	Description
Add	Add new periodic message
Remove	Remove selected message
Start All	Start all enabled periodic messages
Stop All	Stop all periodic messages

8.4 Timing Tab

Configure timing parameters for message transmission.

Settings:

Setting	Description
Min Frame Gap	Minimum time (ms) between consecutive transmissions
TX Timeout	Timeout for transmission confirmation

8.5 History Tab

View and resend previously transmitted messages.

Features:

- Automatically records all sent messages
- Double-click or select + "Resend" to retransmit
- "Load" button copies message back to Send panel for editing
- "Clear History" removes all history entries

Columns:

Column	Description
Time	When message was originally sent
ID	Message ID
Data	Message payload
Flags	EXT, FD, BRS flags

8.6 Predefined Tab

Store frequently used messages for quick access.

Default Predefined Messages:

- **Diag 0x744** - `02 10 01` (Diagnostic session)
- **Diag 0x744 Extended** - `02 10 03` (Extended session)
- **OBD Engine RPM** - `0x7DF` : `02 01 0C` (Request engine RPM)
- **OBD Vehicle Speed** - `0x7DF` : `02 01 0D` (Request vehicle speed)
- **OBD Coolant Temp** - `0x7DF` : `02 01 05` (Request coolant temperature)
- **Tester Present** - `0x7DF` : `02 3E 00` (Keep session alive)

Controls:

Button	Description
Send	Transmit selected predefined message
Add Current	Save current Send panel content as predefined
Remove	Delete selected predefined message

8.7 Grouped Tab

View message statistics grouped by CAN ID.

Columns:

Column	Description
ID	Unique message ID
Count	Number of times this ID was seen
Last Data	Most recent payload for this ID
Last Time	Timestamp of most recent message
Comment	User-defined comment

Controls:

Button	Description
Refresh	Update grouped view with latest data
Clear	Reset all grouped statistics

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9. Features

9.1 Theme Toggle

Click **"Toggle Theme"** button (top-left) to switch between: - **Light Theme**: White background, dark text - **Dark Theme**: Dark background, light text (easier on eyes)

9.2 Export Logs

1. Click **"Export TXT"** in the toolbar
2. Choose save location and filename
3. File contains all messages in human-readable format: ``` CanOEs - Message Log Exported: 2025-12-05 14:30:00 ==========

12:00:01.123 TX 0x123 8 01 02 03 04 05 06 07 08 .....
12:00:01.456 RX 0x456 4 11 22 33 44 ."3D Response ```

9.3 Message Coloring

Messages can be **automatically** color-coded based on their type. This feature is **enabled by default** but can be toggled on/off.

How to enable/disable coloring:

1. In the toolbar above the message list, find **"Color Messages"** checkbox
2. ☑️ **Checked** = Colors are applied to messages
3. ☐ **Unchecked** = All messages displayed in default color (black/white depending on theme)

How it works (when enabled):

- Colors are assigned automatically when messages appear in the list
- No additional configuration needed - it just works!
- Repeated messages without data changes will gradually fade (become grayed out)
- Messages with changing data stay in full color

Color	Type	When Applied
🟢 **Green**	TX	Any message you transmit
🔵 **Blue**	RX	Any message received from the bus
🟠 **Orange**	DIAG	Messages with diagnostic IDs (0x7DF, 0x7E0, 0x7E8, 0x744, 0x74C, 0x700-0x703)
🔴 **Red**	ERR	Error frames
🔘 **Gray**	STALE	Repeated messages with unchanged data (after 5+ repetitions)

Visual Priority:

1. Error frames are always red
2. Diagnostic IDs override TX/RX color (shown in orange)
3. Stale/repeated messages fade to gray regardless of type

When to disable coloring:

- When you need maximum readability in certain lighting conditions
- When preparing screenshots for documentation
- When you prefer a cleaner, monochrome look

9.4 ASCII Preview

Enable **"Show ASCII"** checkbox to see ASCII representation of data bytes: - Printable characters (32-126) shown as-is - Non-printable characters shown as `.`

Example: - Data: `48 45 4C 4C 4F 00 01 02` - ASCII: `HELLO...`

9.5 ID Comments

Add custom comments to CAN IDs for documentation:

1. Click **"Edit Comments"** button
2. In dialog:
3. Enter ID (hex): `744`
4. Enter Comment: `ECU Diagnostic Request`
5. Click **"Add/Update"**
6. Comments appear in the message list and grouped view

Default Comments:

ID	Comment
0x7DF	OBD-II Broadcast
0x7E0	OBD-II ECU Request
0x7E8	OBD-II ECU Response
0x744	Diagnostic Request
0x74C	Diagnostic Response

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10. How-To Guides

This section provides step-by-step instructions for common tasks.

10.1 How to Connect to CAN Bus

Goal: Establish connection to your CAN network

Steps: 1. Plug Vector VN1640A into USB port 2. Wait for Windows to recognize the device 3. Launch CanOEs application 4. In **Connection Panel** (top of window): - Select **Channel**: Usually

`1` (check your physical connection) - Select **Baudrate**: Must match your CAN network (common: 500k) - Check **CAN FD** if your network uses CAN FD - If CAN FD, select **FD Baudrate** (common: 2M) 5. Click **Connect** button 6. Status bar should show "Connected" in green

Troubleshooting: - If "Channel not found" → check USB connection - If no messages appear → verify baudrate matches other devices

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10.2 How to Send a CAN Message

Goal: Transmit a single CAN message

Steps: 1. Ensure you are connected (see 10.1) 2. In **Send Panel**: - Enter **ID** in hex (e.g., `123` or `7DF`) - Check **Extended ID** if using 29-bit ID - Check **FD** for CAN FD message (more than 8 bytes) - Check **BRS** for faster data rate (only with FD) - Enter **Data** in hex with spaces (e.g., `01 02 03 04`) 3. Click **Send** button

Example - Standard OBD-II request: - ID: `7DF` - Extended ID: ☐ - FD: ☐ - Data: `02 01 0C` (request engine RPM)

Example - CAN FD diagnostic: - ID: `744` - Extended ID: ☐ - FD: ☑️ - BRS: ☑️ - Data: `02 10 01` → Click **Pad 00** → auto-fills to 64 bytes

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10.3 How to Filter Messages

Goal: Show only specific CAN IDs

Scenario: You only want to see diagnostic responses (0x74C)

Steps: 1. Go to **Filters** tab 2. Enter filter details: - **Filter Name**: `Diagnostic Response` - **Filter Type**: `Single` - **Single ID**: `74C` - **Accept/Reject**: `Accept` (show matching) 3. Click **Add Filter** 4. Ensure **Enabled** checkbox is checked 5. Return to **Main** tab - only matching messages will appear

Scenario: Hide all messages in range 0x100-0x1FF

Steps: 1. Go to **Filters** tab 2. Enter filter details: - **Filter Name**: `Hide low IDs` - **Filter Type**: `Range` - **From**: `100` - **To**: `1FF` - **Accept/Reject**: `Reject` (hide matching) 3. Click **Add Filter**

10.4 How to Set Up Periodic Messages

Goal: Send a message automatically every X milliseconds

Scenario: Send "Tester Present" every 2 seconds to keep session alive

Steps: 1. Go to **Periodic** tab 2. Enter message details: - **ID**: `7DF` - **Data**: `02 3E 00` - **Interval (ms)**: `2000` (2 seconds) - **Count**: `0` (infinite, or enter number for limited sends) 3. Click **Add** 4. Click **Start All** to begin transmission 5. Watch the Main tab - message appears every 2 seconds 6. Click **Stop All** when finished

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10.5 How to Use Message History

Goal: Resend a message you sent earlier

Steps: 1. Send some messages normally 2. Go to **History** tab 3. You'll see all previously sent messages with timestamps 4. To resend exact same message: - Select the message - Click **Resend** 5. To modify before sending: - Select the message - Click **Load** (copies to Send panel) - Modify as needed - Click **Send**

10.6 How to Use Predefined Messages

Goal: Quickly send frequently used diagnostic messages

Steps to send predefined: 1. Go to **Predefined** tab 2. Select a message (e.g., "OBD Engine RPM") 3. Click **Send**

Steps to add your own predefined: 1. In **Send Panel**, set up your message (ID, data, flags) 2. Go to **Predefined** tab 3. Click **Add Current** 4. Your message is now saved for quick access

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10.7 How to Monitor Specific ECU Communication

Goal: Analyze communication with a specific ECU (e.g., diagnostic tool ↔ ECU)

Scenario: Monitor diagnostic session with ECU using IDs 0x744 (request) and 0x74C (response)

Steps: 1. Connect to CAN bus 2. Go to **Filters** tab 3. Add filter for requests: - Name: `Diag Request` - Type: `Single` - ID: `744` - Accept: ☑️ 4. Add filter for responses: - Name: `Diag Response` - Type: `Single` - ID: `74C` - Accept: ☑️ 5. Go to **Main** tab 6. Click ▶ **Start** to begin receiving 7. Enable **Show ASCII** to see text in data 8. Click **Edit Comments** and add: - ID `744` → Comment: `ECU Request` - ID `74C` → Comment: `ECU Response` 9. Now you see only diagnostic traffic with clear labels

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10.8 How to Export Communication Log

Goal: Save all messages to a file for later analysis

Steps: 1. Capture the messages you want (receive/send) 2. In the toolbar, click **Export TXT** 3. Choose location and filename 4. Click **Save**

The file contains:

```
 CanOEs - Message Log
Exported: 2025-12-05 14:30:00
====================================

Time          Dir  ID       DLC  Data                    ASCII     Flags  Comment
12:00:01.123  TX   0x744    3    02 10 01                ...               Diag Reques
12:00:01.456  RX   0x74C    8    06 50 01 00 19 01 F4 00 .P......          Diag Respon
```

10.9 How to Analyze Message Patterns (Grouped View)

Goal: See how often each CAN ID appears and its latest data

Steps: 1. Start receiving messages 2. Go to **Grouped** tab 3. Click **Refresh** to see statistics 4. Table shows: - How many times each ID was received - Last data payload for each ID - Last timestamp 5. Use this to identify: - Most active IDs on the bus - Which IDs have changing vs static data - Missing expected IDs

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10.10 How to Switch Themes

Goal: Change between light and dark mode

Steps: 1. Click **Toggle Theme** button (top-left corner) 2. Interface switches between: - **Light**: White background (default, good for bright environments) - **Dark**: Dark background (reduces eye strain in dim lighting)

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11. Troubleshooting

Connection Issues

Problem	Solution
"Cannot load vxlapi64.dll"	Install Vector driver package
"Channel not found"	Check VN1640A is connected and powered
"No license"	Ensure valid Vector license is installed
"Access denied"	Close other applications using the channel

Communication Issues

Problem	Solution
No messages received	Check bus termination (120Ω resistors)
TX messages fail	Verify baudrate matches other devices
CAN FD not working	Ensure all devices support CAN FD
Garbled data	Check baudrate settings on all nodes

Application Issues

Problem	Solution
GUI freezes	Stop receiving, reduce message rate
High memory usage	Clear message list periodically
Theme not applying	Restart application

Appendix A: Keyboard Shortcuts

Shortcut	Action
`Enter` (in Send panel)	Send message
`Ctrl+C`	Copy selected messages
`Delete`	Remove selected item (in lists)

Appendix B: CAN FD Data Lengths

Valid CAN FD payload lengths:

DLC	Bytes
0-8	0-8
9	12
10	16
11	20
12	24
13	32
14	48
15	64

Appendix C: Common Diagnostic IDs

ID	Description
0x7DF	OBD-II functional broadcast address
0x7E0	OBD-II ECU physical request

ID	Description
0x7E8	OBD-II ECU physical response
0x700-0x7FF	Standard diagnostic range
0x744	Common diagnostic request (vehicle-specific)
0x74C	Common diagnostic response (vehicle-specific)
