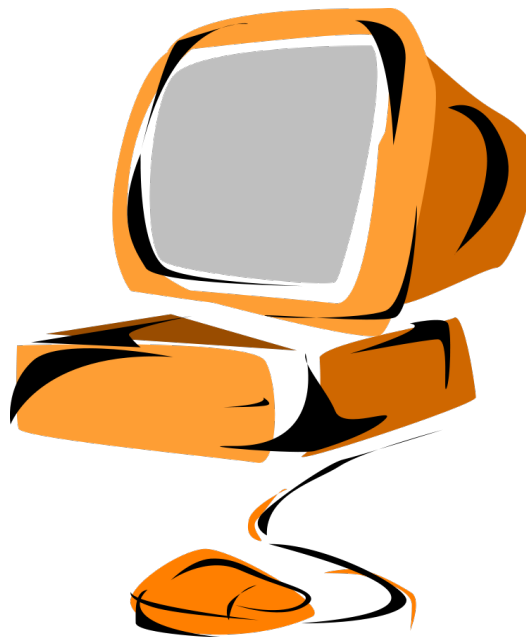




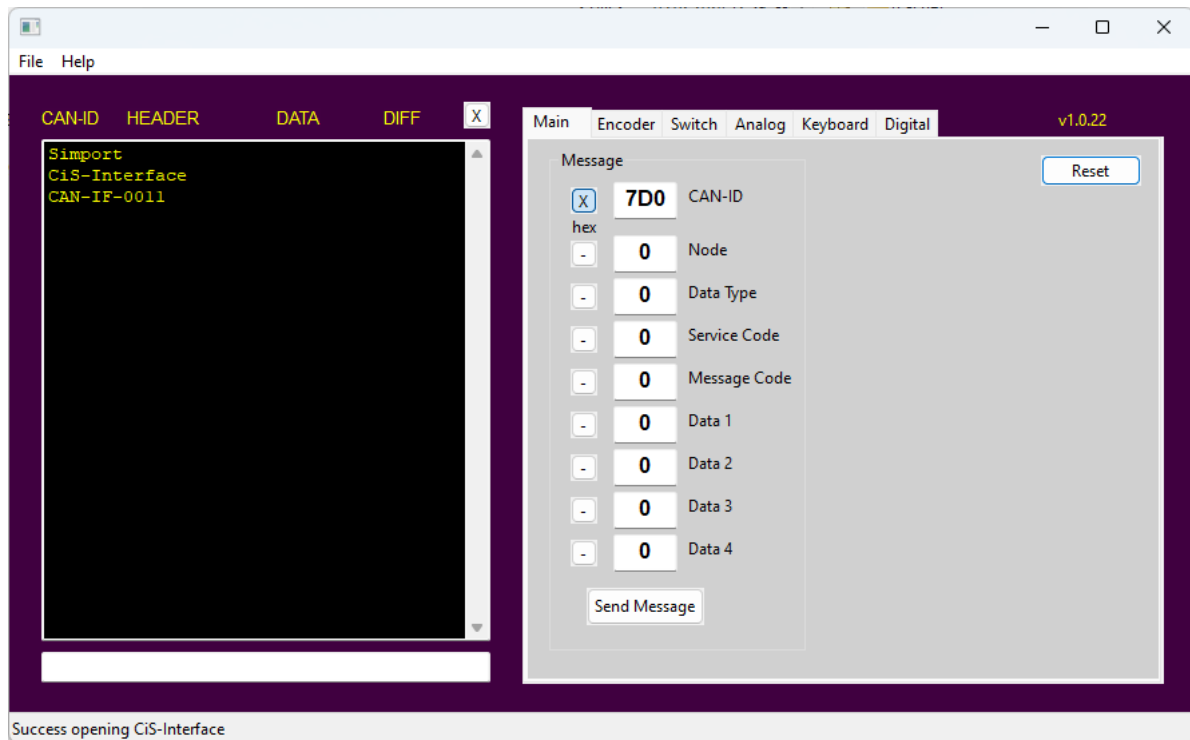
CAN in Simulation
Interface Utility
Program



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Rev. 1.0

The Starting Page



The Starting Page exhibits the standard elements found across all pages.

On the left, you'll find the watch window, initiated with a start message at program launch. The content of this window can be cleared using the small button positioned at the top. This window displays all *CAN messages* from any module in the watch window. Each line commences with the *CAN-ID* of the transmitting module, succeeded by four bytes containing *header information* (Node-ID, data type, module item, message count). Another set of four bytes represents the *data bytes*, with the initial byte as the significant byte. The last column indicates the time difference from the preceding message in milliseconds.

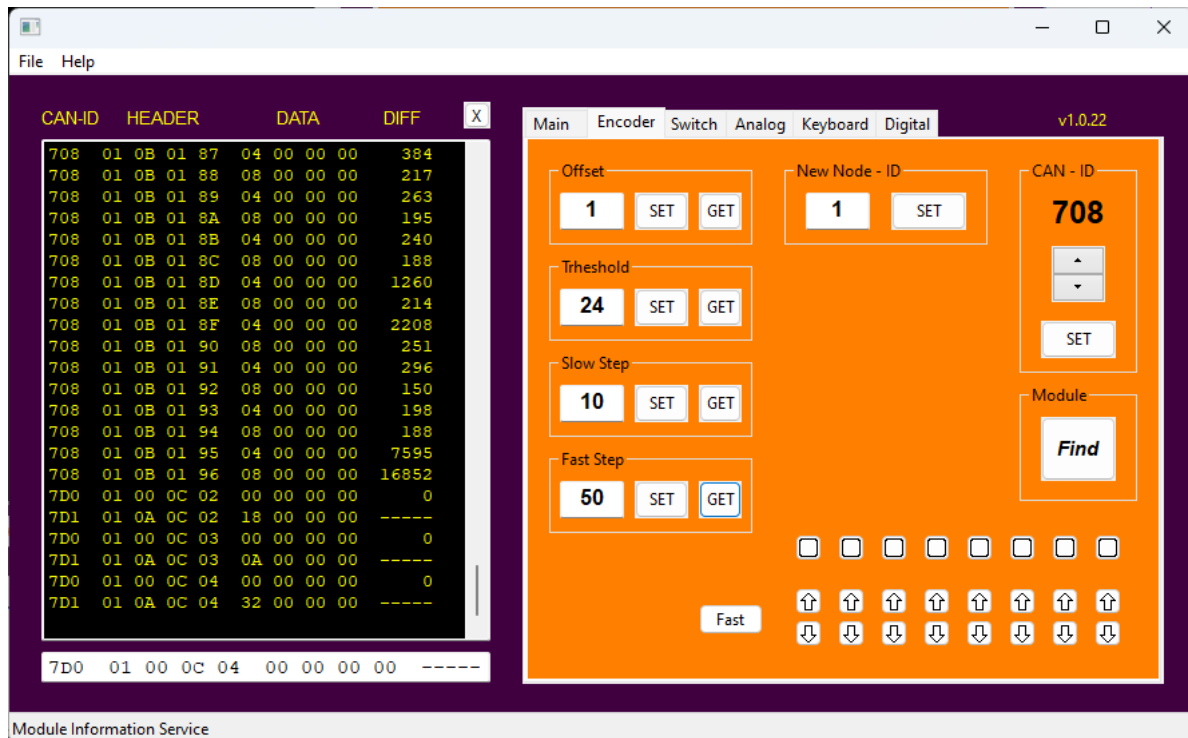
Directly below, a text line displays any CAN output from the USB interface. Meanwhile, on the right side, there is the panel specific to the selected module's page, featuring numeric input fields and action buttons.

A status bar at the bottom provides information about the latest activity and its results, indicating potential errors or successes.

In the right-hand panel, a column of input fields is displayed, forming a complete CAN message. Each value in these fields is editable, and the entire message can be sent by clicking on the „**Send Message**“ button. The small buttons located to the left of each input field toggle between interpreting the input as either *hexadecimal* or *decimal*.

The „**Reset**“ button reestablishes USB communication.

The Encoder Page



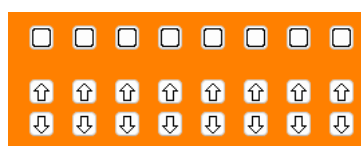
The right-hand panel provides information about an Encoder Module connected to the CAN bus. It includes the „**Node-ID**“, which identifies the module on the bus, and the „**CAN-ID**“ under which the module is broadcasting its messages. If this information is not known in advance, the „**Find**“ button can be used to query the bus for any attached Encoder Modules. The corresponding values will then be displayed. However, upon entering the „Encoder“ page, the system will automatically scan the bus for an Encoder Board and display its parameters. If more than one Encoder Module is found only one will be displayed. The remaining modules can be chosen by disconnecting the displayed module and pressing the „**Find**“ button again.



By entering a new value into the „**Node-ID**“ input field and clicking the „**SET**“ button, the current node ID displayed will be replaced with the new value in the module. It's essential to note that all „**SET**“ buttons on this page pertain to the node whose ID is shown in the „**Node-ID**“ field.

The CAN-ID can also be adjusted within the allowable range. Utilizing the spin buttons, you can select the desired value, and by clicking the „**SET**“ button, the chosen CAN-ID becomes effective.

Four additional parameters can be modified, and the associated „**SET**“ button will update the specified value in the module. The detailed explanations for these parameters can be found in the Encoder Module's handbook.

The adjacent „**GET**“ buttons retrieve the current configuration from the module.

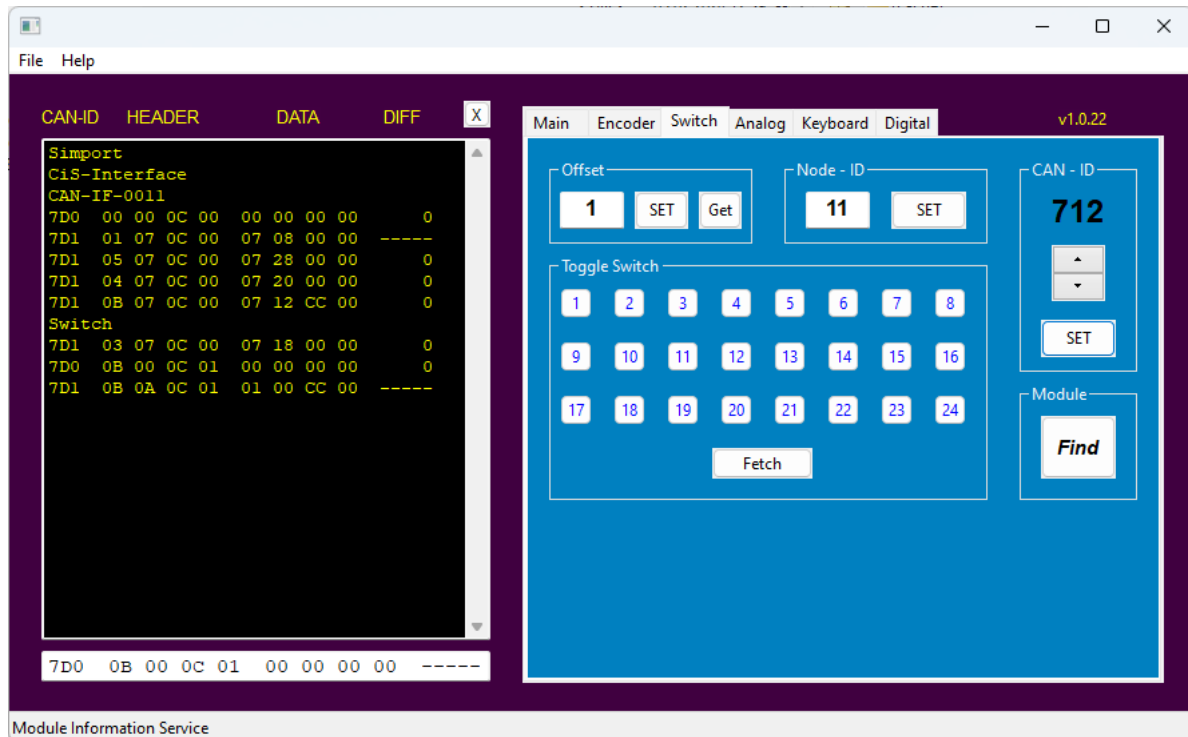


These buttons mirror the actions of the connected Encoder Module. The top row simulates push-buttons: they turn green  when pressed and revert to white  upon release. Simultaneously, the corresponding message is displayed in the watch window. The encoders are arranged from left to right, with increasing encoder numbers.

The bottom two rows depict the left or right turns of an encoder. Each new incoming „*up*“ or „*down*“ message briefly flashes the corresponding  or  arrow. If the rotation speed surpasses the designated threshold, the  button turns red.

In addition to visualizing the current encoder actions on the CAN bus, these actions can also be executed by a mouse click. When the cursor is positioned over one of the upper buttons, a mouse button down event sends the „*pushbutton down*“ message, and a mouse button up event sends the „*pushbutton up*“ message. Similarly, clicking on one of the arrow buttons transmits either an „*encoder right*“ (up) or „*encoder left*“ (down) message on the CAN bus.

The Switch Page



The right-hand panel presents details on a Switch Module linked to the CAN bus. It furnishes the „**No-de-ID**“, identifying the module on the bus, and the „**CAN-ID**“ used for message broadcasting. If this data isn't pre-known, the „**Find**“ button allows querying the bus for attached Switch Modules, and their respective values will be revealed. Furthermore, upon accessing the ‚Switch‘ page, the system automatically scans the bus for a Switch Board and exhibits its parameters. In the event of multiple Switch Modules, only one is initially shown, with the option to cycle through the rest by disconnecting the displayed module and utilizing the „**Find**“ button anew.

The „**Node-ID**“ of the module in question can be modified by replacing the displayed value with a new one and then pressing the „**SET**“ button. It's crucial to ensure that each module on the bus possesses a unique ID.

The „**CAN-ID**“ can be adjusted by choosing a new value using the up/down spin buttons within the predefined range, followed by pressing the „**SET**“ button.

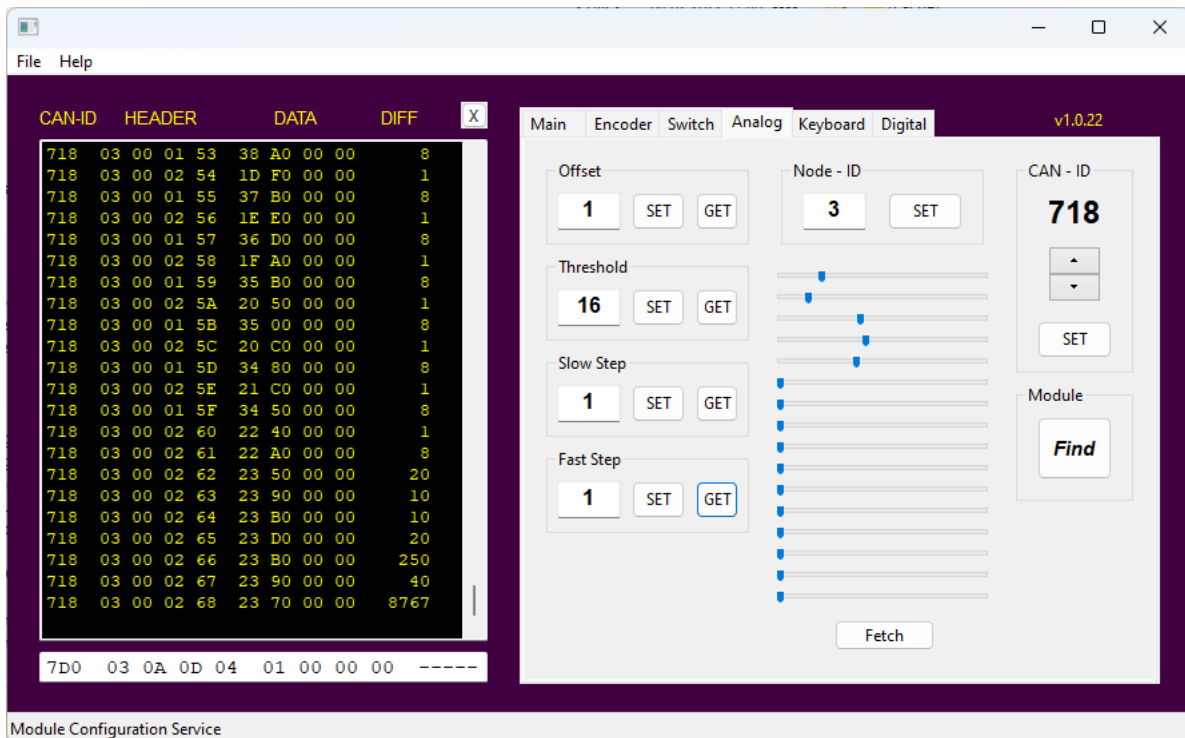
The „**Offset**“ value can be modified as well, and the associated „**SET**“ button will update the specified value in the module. The detailed explanation for this parameter can be found in the Switch Module's handbook.

The adjacent „**GET**“ button retrieve the current configuration from the module.

The „**Toggle Switch**“ field corresponds to the 24 switches of the connected switch board. Upon pressing the „**Fetch**“ button, the module is queried for the current state of all switches. Closed switches are displayed in green. Any subsequent change in switch state, whether closed or opened, is promptly reflected in the switch field.

Alternatively, you can transmit a ‚switch‘ message by clicking on one of the switch icons with the mouse. The sent message utilizes the ‚CAN-ID‘ and ‚Node-ID‘ displayed in their respective text fields. This functionality operates seamlessly even in the absence of a physical board connected to the bus. Additionally, the Offset value determines the effective switch number within the message.

The Analog Page



This panel provides information about an Analog Module connected to the CAN bus. It displays the „**Node-ID**“, identifying the module on the bus, and the „**CAN-ID**“ used for message broadcasting. If this data isn't known beforehand, the „**Find**“ button allows querying the bus for attached Analog Modules, revealing their respective values. Additionally, upon accessing the „*Analog*“ page, the system autonomously scans the bus for an Analog Board and showcases its parameters. In case of multiple Analog Modules, only one is initially displayed, with the option to cycle through the others by disconnecting the displayed module and using the „**Find**“ button again.

The „**Node-ID**“ of the module in question can be modified by replacing the displayed value with a new one and then pressing the „**SET**“ button. It's crucial to ensure that each module on the bus possesses a unique ID.

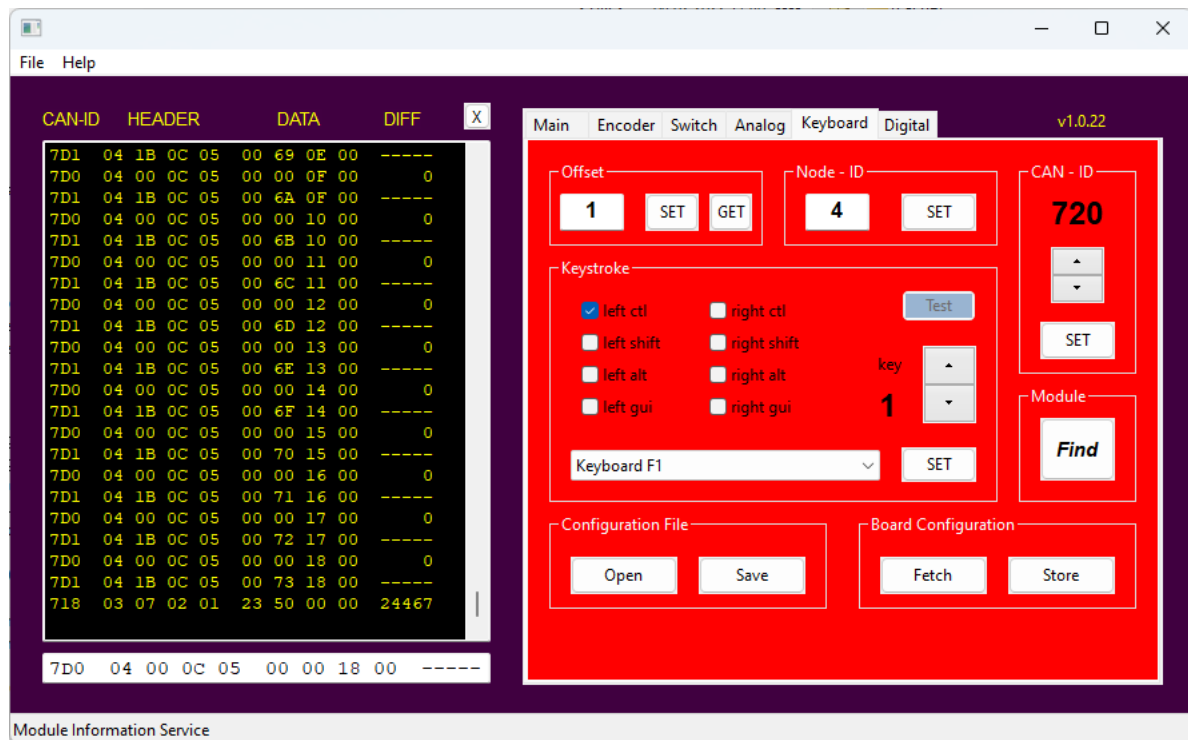
The „**CAN-ID**“ can be modified by selecting a new value using the up/down spin buttons within the predefined range, and then pressing the „**SET**“ button.

You can adjust four additional parameters, and pressing the associated „**SET**“ button will update the specified value in the module. Detailed explanations for these parameters can be found in the Analog Module's handbook.

A set of 16 horizontal sliders depicts the current state of the attached board. The top 8 correspond to the 8 potentiometers that can be connected to the board, while the lower 8 are associated with the encoders that can also be connected. The „**Fetch**“ button queries the Analog Board for the current values and adjusts the sliders accordingly. Whenever a potentiometer or an encoder is adjusted, the sliders are updated in real-time.

You also have the option to send an „analog“ message by simply moving one of the sliders with the mouse. This action utilizes the „CAN-ID“ and „Node-ID“ shown in their respective text fields. Notably, this feature functions smoothly even if there isn't a physical board connected to the bus. Moreover, the Offset value specifies the effective item number within the message.

The Keyboard Page



The right-hand panel provides information about a Keyboard Module connected to the CAN bus. It displays the „**Node-ID**“, identifying the module on the bus, and the „**CAN-ID**“ used for message broadcasting. If this data isn't already known, the „**Find**“ button allows querying the bus for attached Keyboard Modules, revealing their respective values. Additionally, upon accessing the ‚Keyboard‘ page, the system autonomously scans the bus for a Keyboard Board and displays its parameters. If multiple Keyboard Modules are present, only one is initially shown, with the option to cycle through the others by disconnecting the displayed module and using the „**Find**“ button again.

You can modify the „**Node-ID**“ of the module by replacing the displayed value with a new one and then pressing the „**SET**“ button. Ensuring that each module on the bus has a unique ID is crucial.

The „**CAN-ID**“ can be adjusted by selecting a new value using the up/down spin buttons within the predefined range, followed by pressing the „**SET**“ button.

The „**Offset**“ value is also adjustable, and pressing the associated „**SET**“ button will update the specified value in the module. Further details about this parameter can be found in the Keyboard Module's handbook.

The „**Keystrokes**“ field features 8 checkboxes for *modifier* selections, up/down spin buttons to select a *key number*, a selector field for the *key code*, and a „**SET**“ button. The spin buttons enable the selection of one of 24 possible keys for editing. The preset values for this key are displayed in the selector field and the modifier checkboxes.

The keycode is an 8-bit value, allowing for up to 256 different codes. These codes, used for keyboards, are well-defined by the *USB Implementer's Forum* and are all selectable through the selector field. Additionally, any keycode can be accompanied by one or more modifiers, activated by individual checkboxes. Pressing the „**SET**“ button applies the current settings to the attached board.


At the start of the program, no keycodes are set, and all modifiers are cleared.

The „**Open**“ button reads a configuration file in JSON format, populating an internal list with the values found in the file. You can navigate through this list using the key number spin buttons to view its contents. Any modifications you make by editing the values will update this list accordingly. The „**Save**“ button then stores the internal list in a new JSON file or overwrites an existing one. JSON files are easily readable by humans and can also be edited outside the program using a simple text editor.

The „**Fetch**“ button, on one hand, queries the attached board for its current settings and updates the internal list, overwriting any previously stored data. Conversely, the „**Store**“ button updates the board's settings with the values from the internal list.

The JSON file utilized with the keyboard module maintains the following structure, which must be adhered to:

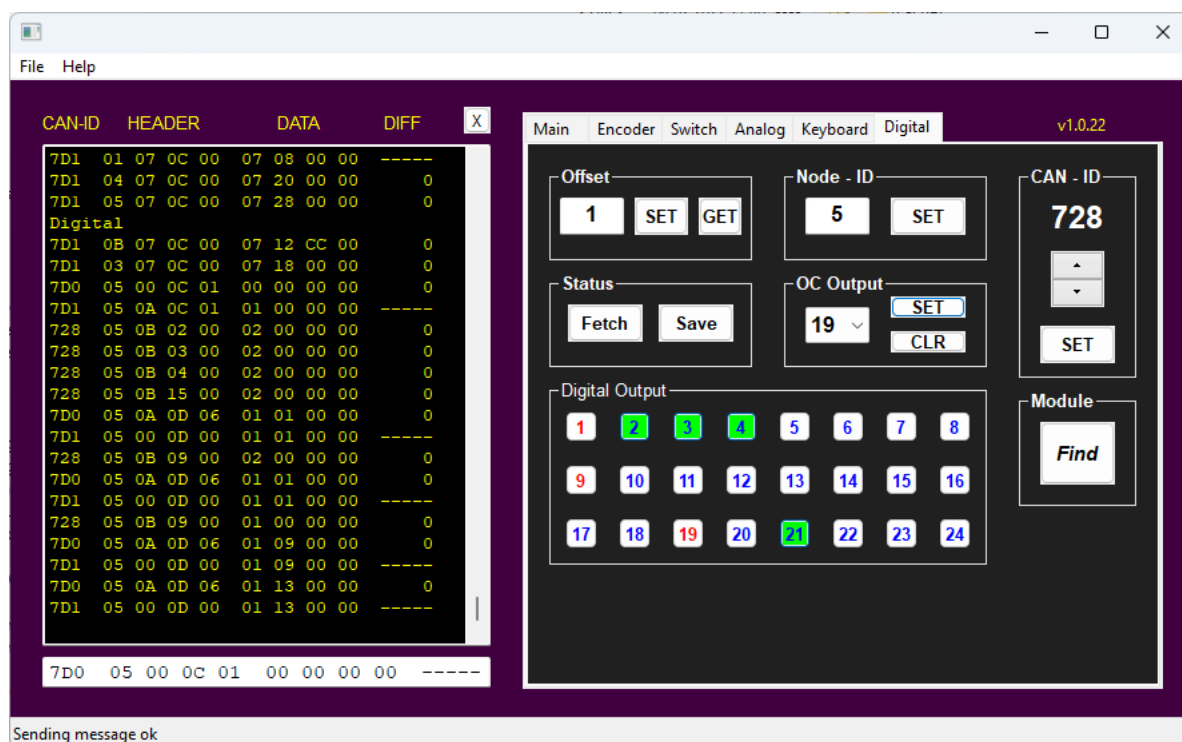
```
{
  „name“:      „CiS key assignments“,
  „keys“:      [{
    „key“:      1,
    „keycode“:  90,
    „modifier“: 0
  }, {
    „key“:      2,
    „keycode“:  59,
    „modifier“: 0
  }, {
    „key“:      23,
    „keycode“:  114,
    „modifier“: 0
  }, {
    „key“:      24,
    „keycode“:  115,
    „modifier“: 0
  }
  ]
}
```



- „key“: is the number of the board's key input (1 ... 24).
- „keycode“: is the code representing the actual keystroke.
- „modifier“: is a bit combination of the accompanying modifiers.

For a thorough understanding of the keycodes and modifier bit combinations, please refer to the handbook of the Keyboard Module.

Keyboard messages transmitted over the CAN bus are not received by this program; instead, they are directed to the keyboard section, which operates independently as part of the Interface Module.



The right-hand panel offers details about a Digital Module linked to the CAN bus. It presents the „**No-de-ID**“, identifying the module on the bus, and the „**CAN-ID**“ used for message broadcasting. If this data isn’t already known, the „**Find**“ button allows querying the bus for attached Digital Modules, revealing their respective values. Moreover, when accessing the ‚Digital‘ page, the system autonomously scans the bus for a Digital Board and showcases its parameters. In case of multiple Digital Modules, only one is initially displayed, with the option to cycle through the others by disconnecting the displayed module and using the „**Find**“ button again.

You can modify the „**Node-ID**“ of the module by replacing the displayed value with a new one and then pressing the „**SET**“ button. Ensuring that each module on the bus has a unique ID is crucial.

The „**CAN-ID**“ can be adjusted by selecting a new value using the up/down spin buttons within the predefined range, followed by pressing the „**SET**“ button.

Additionally, the „**Offset**“ value is adjustable, and pressing the associated „**SET**“ button updates the specified value in the module. Further details about this parameter can be found in the Digital Module’s handbook.

The status of the attached board, indicating whether an output is set to ‚low‘ or ‚high‘ and if an output is configured for ‚push-pull‘ or ‚open-collector‘, can be queried using the „**Fetch**“ button. In the field representing the outputs, an open-collector output is denoted by a **red** number, while a push-pull output is indicated in **blue**. A ‚low‘ output (pulled to ground) is represented by a green square, and a ‚high‘ output (left open or pulled to +5V) is depicted as a white square.

To configure a specific output as open-collector or push-pull, simply select the output’s number in the „**OC Output**“ field and then press either the „**SET**“ or „**CLR**“ button accordingly.

Clicking on one of the output buttons toggles the corresponding output on the attached board.

The „**Save**“ button stores the current configuration in non-volatile storage on the board.