

Software Manual – Programming and Integration

SEA 4912 / SEA 4914

2.4" / 4.3" Display Modules for CompactRIO™



SEA Science & Engineering
Applications Datentechnik
GmbH

Doc. No.: HB/SEA 491x SoftwareManual/1.1.1/May-2015

Subject to modifications.

S.E.A. Datentechnik GmbH takes no responsibility for damage arising out of or related to this document or the information contained in it.

Product and company names listed are trademarks or trade names of their respective companies.

© Science & Engineering Applications Datentechnik GmbH

Address:

S.E.A. Datentechnik GmbH
Muelheimer Strasse 7
53840 Troisdorf
Germany

Phone: +49 2241 12737-0

Fax: +49 2241 12737-14

For support please contact the support email address:

techsupport@sea-gmbh.com

Contents

| | | |
|----------|--|-----------|
| 1 | Change Notes..... | 4 |
| 2 | About This Manual..... | 5 |
| 2.1 | Important Notes..... | 5 |
| 2.2 | Symbols..... | 5 |
| 2.3 | Nomenclature..... | 5 |
| 3 | Installation..... | 6 |
| 3.1 | Hardware Requirements..... | 6 |
| 3.2 | Software Requirements..... | 6 |
| 4 | Quick Start..... | 7 |
| 5 | Description of Functionality..... | 9 |
| 5.1 | Platforms..... | 9 |
| 5.2 | SEA 491x Functionality..... | 9 |
| 5.3 | Power up, Reset..... | 9 |
| 6 | Programming..... | 10 |
| 6.1 | Examples..... | 10 |
| 6.2 | API..... | 10 |
| 6.3 | Tools..... | 12 |
| 6.3.1 | New Template Application..... | 12 |
| 6.3.2 | Calibrate Touch Screen..... | 13 |
| 7 | Deployment..... | 14 |
| 8 | Error Codes..... | 15 |
| 9 | Trouble Shooting..... | 16 |
| A | Figures..... | 17 |
| B | Tables..... | 18 |

1 Change Notes

| # | Version | Changes |
|---|---------|---|
| 1 | 1.0.0 | Initial release |
| 2 | 1.1.0 | Feature release: - Graphical Screen Editor (as a separate add-on toolkit) introduced and therefore driver tools revamped |
| 3 | 1.1.1 | Maintenance release: - Installation chapter improved - Deployment chapter added - Error codes updated |

2 About This Manual

2.1 Important Notes

Before starting to work with SEA 4912 / SEA 4914 please read the complete hardware manual and the following document carefully.

This manual is delivered as a PDF document with the possibility of full-text search. It is recommended to use the latest version of the Adobe® Acrobat® Reader® which you can get here: <http://www.adobe.com/>.







The notation SEA 491x is a short cut for a family of modules. If you read SEA 491x you can substitute it with the name of your particular type (SEA 4912 / SEA 4914). If any information contained in this manual refers exclusively to a particular module type, then this particular module name is used instead of SEA 491x.



Before operating the SEA 491x module and the provided software you have to agree to the terms and conditions (EULA). This agreement is part of the software installation procedure. In addition, the terms and conditions are available through the LabVIEW menu after installation (Tools > SEA > product name > Legal Information). If you do NOT agree you can send back the hardware and software package within a period of two weeks after delivery. In this case S.E.A. will refund the product price and shipping costs.

2.2 Symbols

To improve clarity specific structuring elements (or symbols) are used which have the following meaning:

| Symbol | Meaning |
|---|---|
| <i>Names</i> | Specific names are printed using an <i>italic font</i> |
| [Text] | Place holders are marked by squared brackets |
|  | Locations (paths, menus, URLs...) are printed using a <code>courier font</code> |
|  | The yellow sign highlights important notes and warnings |
|  | The blue mark highlights tips |
|  | Reference to other documents |

Tab. 1: Symbols

We believe that all information in this manual is accurate.

The document has been carefully reviewed for technical accuracy. In the event of technical or typographical errors, we reserve the right to make changes to subsequent editions of this document without prior notice to holders of this edition. The reader should consult the vendor if errors are suspected.

2.3 Nomenclature

For a better understanding, a short list of used terms will be given:

| Name | Meaning |
|------|-----------------------------------|
| API | Application Programming Interface |
| NI | National Instruments |
| RT | Real Time |
| VI | Virtual Instrument |
| VIPM | VI Package Manager |

Tab. 2: Nomenclature

3 Installation

There is a single, common driver software for the module types: SEA 4912 / SEA 4914. The driver software can be downloaded either from the NI Tools Network or from our download site.



The required installation files are not enclosed with the module due to continuous improvements. The latest version of the driver software can be downloaded from the support area at: <http://www.sea-gmbh.com>

Click *Download Area* button and select your module type from the *Hardware Products* category.

The driver software is to be installed on a development PC only (refer to the hardware requirement section below). In order to install the software package double-click or open the .vip file inside the VI Package Manager and follow the instructions on the screen. This procedure installs the driver including application programming interface (API), tools, examples and all related manuals. Further resources (if available) like application notes, drawings etc. can be downloaded separately from the location as stated above.

3.1 Hardware Requirements

The SEA 491x module requires at least a PC to program the application. The same PC can also be used to run the application if a serial port is available. Typically the application runs on a NI CompactRIO Real-Time controller with the SEA display connected via the serial port.



The driver software requires a PC for programming (development PC) and any device, capable of running compiled LabVIEW code (exe, rtexe) and providing a serial port, to run the application (run-time device).



The default settings for the serial port are: 9600 Baud, 8 Bits, No Parity, 1 Stop Bit (8N1).

3.2 Software Requirements

The development PC and run-time device are described in the hardware requirements section above.

Software requirements for the development PC:

- JKI VI Package Manager 2014 or higher
- NI LabVIEW Development environment 2011 or higher
- NI LabVIEW Real-Time 2011 or higher (only if the application is intended to run on a real time target, i.e. NI CompactRIO)

Software requirements for the run-time device, i.e. NI CompactRIO:

- NI LabVIEW Run-Time Engine / LabVIEW Run-Time Engine for Real-Time targets
- NI Serial



For operation on a NI CompactRIO system the *NI Serial* package is strictly required to be installed on the target system, otherwise the serial port on CompactRIO won't work.

4 Quick Start

This section describes how easy the SEA 491x display module can be integrated and programmed. Further ready-to-use examples are available in the example finder (keywords: 4912, 4914).



Refer to the hardware manual for proper installation of the hardware.

Please follow the steps below to create a simple application using the SEA 491x module (for this tutorial exemplary the SEA 4914 has been used) and run it on a CompactRIO system (the same instructions apply, if a PC is used instead of a CompactRIO system; the only difference is the assignment of the application to the *My Computer* execution target):

1. Connect the SEA 491x with your CompactRIO system using the enclosed serial communication cable. Supply power to the module through the power connector. Make sure the SEA 491x driver software package is installed on the development PC.
2. Connect your CompactRIO system to the development PC via an Ethernet cable and ensure correct IP configuration of participating devices. Power up all hardware components.
3. Start LabVIEW and select *New* → *Empty Project* within the *Getting Started* window.
4. The project explorer window appears. In this window select the uppermost item in the tree (*Project: Untitled Project X.lvproj*) and select *New* → *Targets and Devices* by right-clicking on it, like shown below:

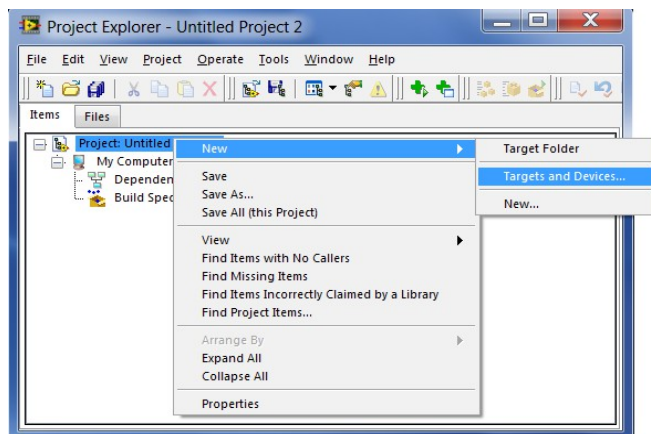


Fig. 1: Quick Start – Add Target

5. Choose *Discover an existing target(s) or device(s)* and unfold the *Real-Time CompactRIO* folder.
6. Select your CompactRIO system from the list of available targets.
7. Finalize the configuration of the FPGA, however the FPGA part is not relevant for this tutorial.

Now the project is fully configured to use the SEA 491x module in the Real Time target (without FPGA).

8. Create a new RT VI in the project explorer window. For this right-click on the RT *Target (RIO0...)* and select *New* → *VI*. Refer to the figure below:

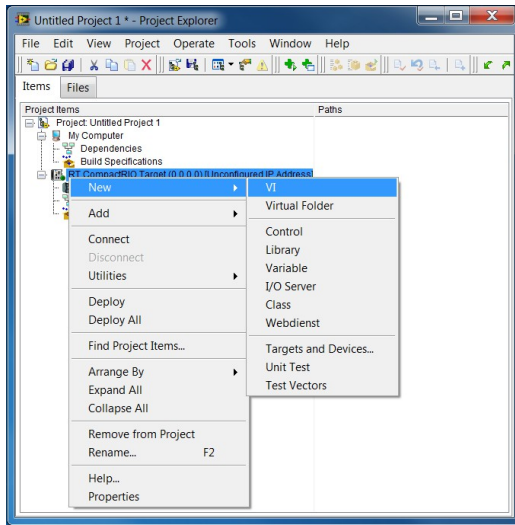


Fig. 2: Quick Start - Add VI

9. Open the block diagram of the VI you just created and place the *Open Connection VI* from the functions palette on the block diagram.
10. Place the *Get Module info VI* from the SEA 491x functions palette on the block diagram.
11. Place the *Close Connection VI* from the SEA 491x functions palette on the block diagram.
12. Pass an appropriate VISA Resource to the *VISA Session In* input of the *Open Connection VI* and connect the *VISA Session* and *error* throughout all subsequent VI finishing with the *Close Connection VI*. The final code should look similar to the block diagram shown in Fig. 3.

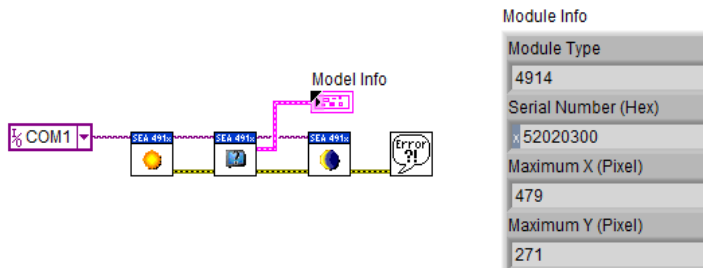


Fig. 3: Quick Start – Simple Application

13. Save the created RT VI and run it. The indicator *Module Info* should return some values upon successful execution, refer to Fig. 3. Please note that the *Serial Number (Hex)* is unique for each module, whereas the other value should be equal to the values shown in Fig. 3.

All API functions are accessible through the functions palette. For a complete list of available function, please refer to section *Programming* later in this document.

5 Description of Functionality

5.1 Platforms

A LabVIEW application for SEA 491x does not run on the display module itself, but rather on a device connected with the display module via RS-232. This device needs to satisfy two requirements: featuring a RS-232 interface and be capable of running LabVIEW programs (at least LabVIEW Run Time Engine is required). The device can be a PC, any NI CompactRIO system, a NI Single-Board RIO system with a real time controller or any other device.

For the development of a SEA 491x based application a PC containing LabVIEW Development Environment is required.

5.2 SEA 491x Functionality

SEA 491x is an intelligent display module for text and graphic. The application runs on a connected device and communicates with the display module through the serial port. The SEA 491x features a touch screen functionality enabling interactive applications. Peripherals like input devices, switches or lamps can be integrated using the general purpose IOs. Finally a simple sound playback can be implemented using the internal speaker.

All features of the display module are accessible through the programming library (API) that comes along with the driver software.



The driver software is required for operation of the SEA 491x module. It provides the programming interfaces (API), tools and examples. The driver is not enclosed with the module when shipped, but need rather to be downloaded separately from the support area at: <http://www.sea-gmbh.com>. This is a free download at no additional costs.



In order to simplify the screen layout design an optional tool called Graphical Screen Editor is separately available. This tool provides a graphical editor, which allows to compose one or multiple screens directly in a LabVIEW front panel. The configuration is exported to a file, which can be used in the driver. The Graphical Screen Editor can be downloaded either from the NI Tools Network or from our support area at: <http://www.sea-gmbh.com>. Graphical Screen Editor can be free evaluated (free evaluation period) and requires a paid-license for commercial use.

5.3 Power up, Reset

When the SEA 491x module is powered up a start screen is displayed, when no communication takes place. The start screen contains some main information about the module, like the type, serial number and the firmware version.



Wait at least 5 sec. after power up or reset of the module before starting to communicate with the module. The start screen indicates that the module is ready for operation.

6 Programming

6.1 Examples

The driver software is delivered with a set of examples that demonstrate a specific aspect of the module. Please refer to the examples to learn how to program the module and how to retrieve position and time values.



The examples are available via the example finder.

Use the search keyword *4912* or *4914* to find related examples.

6.2 API

SEA 491x features a LabVIEW API that is available from the functions palette after installation of the driver software. The functions are organized in sub palettes:

- SEA 491x palette: this is the main palette containing some common functions and the access to further specialized sub-palettes.

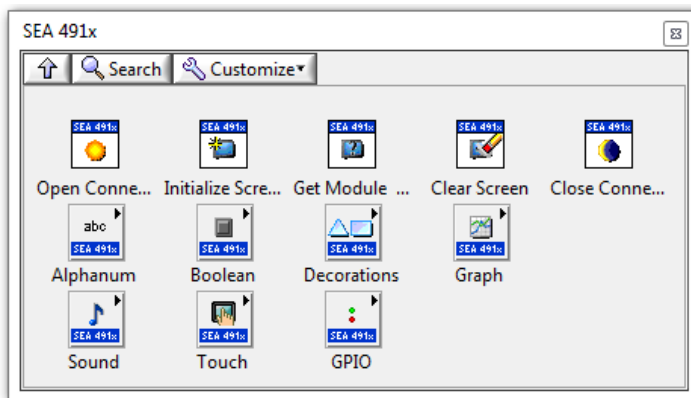


Fig. 4: Functions Palette – SEA 491x

- Alphanum palette: contains functions to draw text based objects with updateable values, like counter or measurement value.

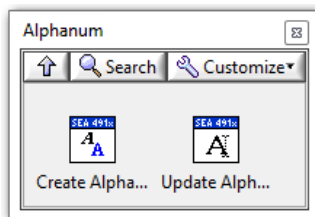


Fig. 5: Functions Palette – Alphanum

- Boolean palette: contains functions to draw interactive (updateable) buttons .

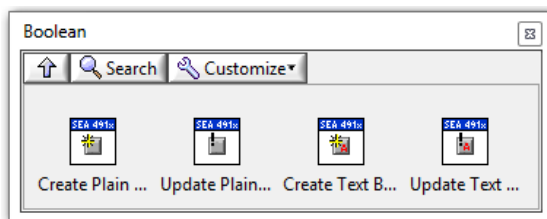


Fig. 6: Functions Palette – Boolean

- Decorations palette: contains functions to draw static (non-updateable) graphic and text objects.

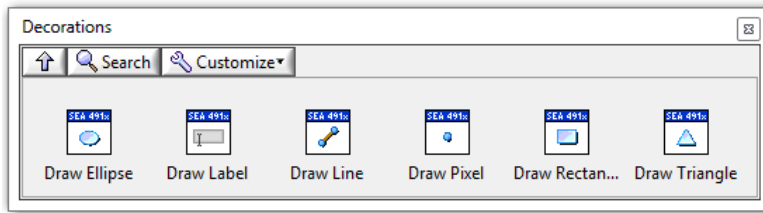


Fig. 7: Functions Palette – Decorations

- Graph palette: contains functions to draw updateable chart and bar graph objects.

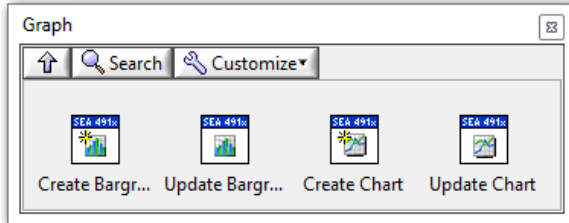


Fig. 8: Functions Palette – Graph

- GPIO palette: contains function to read and write integrated general purpose IOs.

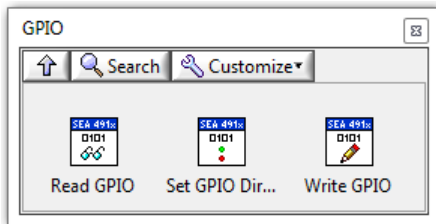


Fig. 9: Functions Palette – GPIO

- Touch palette: contains functions to implement user interactivity (touch events).

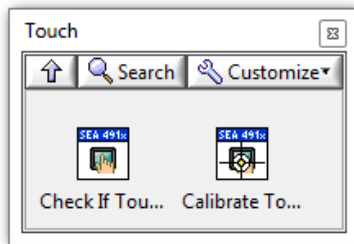


Fig. 10: Functions Palette – Touch

- Sound palette: contains functions for audio playback.

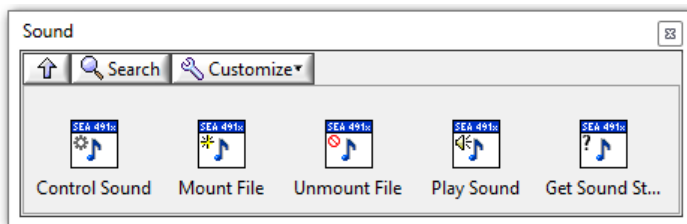


Fig. 11: Functions Palette – Sound

For detailed description of each function please refer to the description (VI description and control/indicator description) in LabVIEW. Please note that some functions may be not available for particular module types. If a function is not available, an error with the code 5900 is returned.

6.3 Tools

The driver software comes with a set of tools that cover more advanced topics of the modules.



The tools are available via the LabVIEW menu:

LabVIEW menu -> Tools -> SEA -> SEA 491x

Further toolkit are separately available. Please refer to our web page for details.

6.3.1 New Template Application

To accelerate the implementation process of a typical application a template VI is provided as a starting point. The template VI needs to be completed according to the steps showed on the block diagram before running. The template VI works like follows:

- (a) First of all opens the connection to the display
- (b) Defines the static part of the display screen by creating objects
- (c) Detects touch events on the display and in parallel
- (d) Updates values of defined objects
- (e) When STOP button is pressed, closes the connection to the display

The definition of the static part of the screen can be done either programmatically (by using the API functions) or graphically (by using the Graphical Screen Editor). For the programmatic method the API functions that create objects need to be implemented. **For the graphical method the Graphical Screen Editor is required to create a configuration file (XML).** This tool is separately available. It provides a full-featured 30-days evaluation period for testing purposes.

To complete the template with the **programmatical method** please follow these steps:

1. From the LabVIEW menu select:
Tools -> SEA -> SEA 491x -> New Template Application...
2. Enable the programmatic method on the block diagram.
3. Parametrize the screen parameter and all object parameter on the block diagram.
4. Parametrize all other locations on the block diagram according to the instructions given on the block diagram.
5. Set the proper serial port in the new template application and connect the module to that port. Power up the display module.
6. Run the application.

To complete the template with the **graphical method** please follow these steps:

1. Create a configuration file (XML) with the Graphical Screen Editor (free evaluation time period).
2. From the LabVIEW menu select:
Tools -> SEA -> SEA 491x -> New Template Application...
3. Enable the graphical method on the block diagram.
4. Parametrize the configuration file (XML) on the block diagram.
5. Parametrize all other locations on the block diagram according to the instructions given on the block diagram.
6. Set the proper serial port in the new template application and connect the module to that port. Power up the display module.
7. Run the application.

6.3.2 Calibrate Touch Screen

Occasionally a calibration of the touch screen may be required, if the touched area is not detected properly. Please complete the following steps calibrate the touch screen:

1. To perform the calibration procedure an adequate stylus (plastic, wood) to interact with the display module is best suited.
2. Connect the display module to the PC using the enclosed serial communication cable and supply power to the display module.
3. Call the calibration function from the LabVIEW menu:
Tools -> SEA -> SEA 491x -> Calibrate Touch Screen...
4. Follow the instructions on the screen interacting with an adequate stylus.
5. Upon completion the display module performs a restart to finish the calibration procedure.

7 Deployment

If the application is deployed to a run-time target system like NI CompactRIO the following parts are necessary to be deployed along with the compiled application (i.e. rtexe):

- LabVIEW 2011 or higher Run-Time Engine
- NI Serial software package need to be installed on the target system
- If a configuration file (XML) is used in the application this file need to be deployed along in order to be available on the target system at the location programmed in the application, refer to the *Config File* input of the *Open Connection* API function.

To see how the configuration file (XML) can be deployed along with the application refer to the *Config_Example.lvproj* for SEA 4912 / SEA 4914 available through the LabVIEW Example Finder.

8 Error Codes

In case of any error the API returns errors or warnings in the *error out* cluster of the originating API function. The following errors are defined:

| Error Code | Meaning |
|------------|--|
| 402940 | Function not available for current module type |
| 402941 | Interface Error: hardware-related error occurred |
| 402942 | Unknown module detected |
| 402943 | Configuration file (XML) not loaded |
| 402944 | Protocol Error: module has not responded according to the protocol |
| 402945 | Timeout Error: module had not responded within the time out period |
| 402946 | No-Ack Error: module has not acknowledged the last command |

Tab. 3: Error Codes

The driver software installs a custom error file for the above errors. The file contains a detailed description of the error as well as proposals for possible solutions. To see the description select *Explain Error...* from the *Help* item of the LabVIEW menu and enter one of the above listed error codes.

9 Trouble Shooting

The following hints might help you to determine if the module and/or software behave correctly and how to identify module failures.

| # | Problem | How to solve |
|---|--|---|
| 1 | The module does not show the start screen after power up | <ol style="list-style-type: none"> 1. Make sure the module is supplied with power (7 to 30V). If yes module may be destroyed – please contact S.E.A. |
| 2 | Module does not show the programmed screen | <ol style="list-style-type: none"> 1. Check if module is connected with the device running the application via the serial communication cable. 2. Check if the serial port configuration is correct done on both ends. Restart the module each time these setting change. 3. Check if the right VISA Resource (like COM1) is passed to the <i>Open Configuration VI</i>. 4. Check if both DIP Switches on the back side of the display module are set to OFF. |
| 3 | Module updates values very slow | <ol style="list-style-type: none"> 1. Every value update (text or graphic) takes some dozens of milliseconds. This cannot be accelerated even if higher Baud rates are used, because the entire time is consumed inside the module processing the given command. 2. Optimization can be made reducing the number of object to be updated i.e. combining multiple values in a single object. 3. The SEA 9412 is limited to max. 2Hz on updating of chart plots by nature. SEA 4914 is much faster (max. ca. 10Hz) |
| 4 | Some objects are not shown although defined | <ol style="list-style-type: none"> 1. This can be caused by the selected colour. Change the colour and try again. 2. The object is not entirely inside the screen frame. |
| 5 | Touch function does not work | <ol style="list-style-type: none"> 1. Ensure that touch is enabled in the <i>Initialize Screen</i> function. 2. Re-calibrate the touch screen. 3. Check if touch works with the Config Example. |
| 6 | Sound is not played correctly | <ol style="list-style-type: none"> 1. The sound playback feature is limited. Problems may occur if incompatible files are used. Refer to the respective API VIs for details. |

Tab. 4: Trouble shooting

A Figures

| | |
|--|-----------|
| Fig. 1: Quick Start – Add Target..... | 7 |
| Fig. 2: Quick Start - Add VI..... | 8 |
| Fig. 3: Quick Start – Simple Application..... | 8 |
| Fig. 4: Functions Palette – SEA 491x..... | 10 |
| Fig. 5: Functions Palette – Alphanum..... | 10 |
| Fig. 6: Functions Palette – Boolean..... | 10 |
| Fig. 7: Functions Palette – Decorations..... | 11 |
| Fig. 8: Functions Palette – Graph..... | 11 |
| Fig. 9: Functions Palette – GPIO..... | 11 |
| Fig. 10: Functions Palette – Touch..... | 11 |
| Fig. 11: Functions Palette – Sound..... | 11 |

B Tables

| | |
|--------------------------------------|-----------|
| Tab. 1: Symbols..... | 5 |
| Tab. 2: Nomenclature..... | 5 |
| Tab. 3: Error Codes..... | 15 |
| Tab. 4: Trouble shooting..... | 16 |