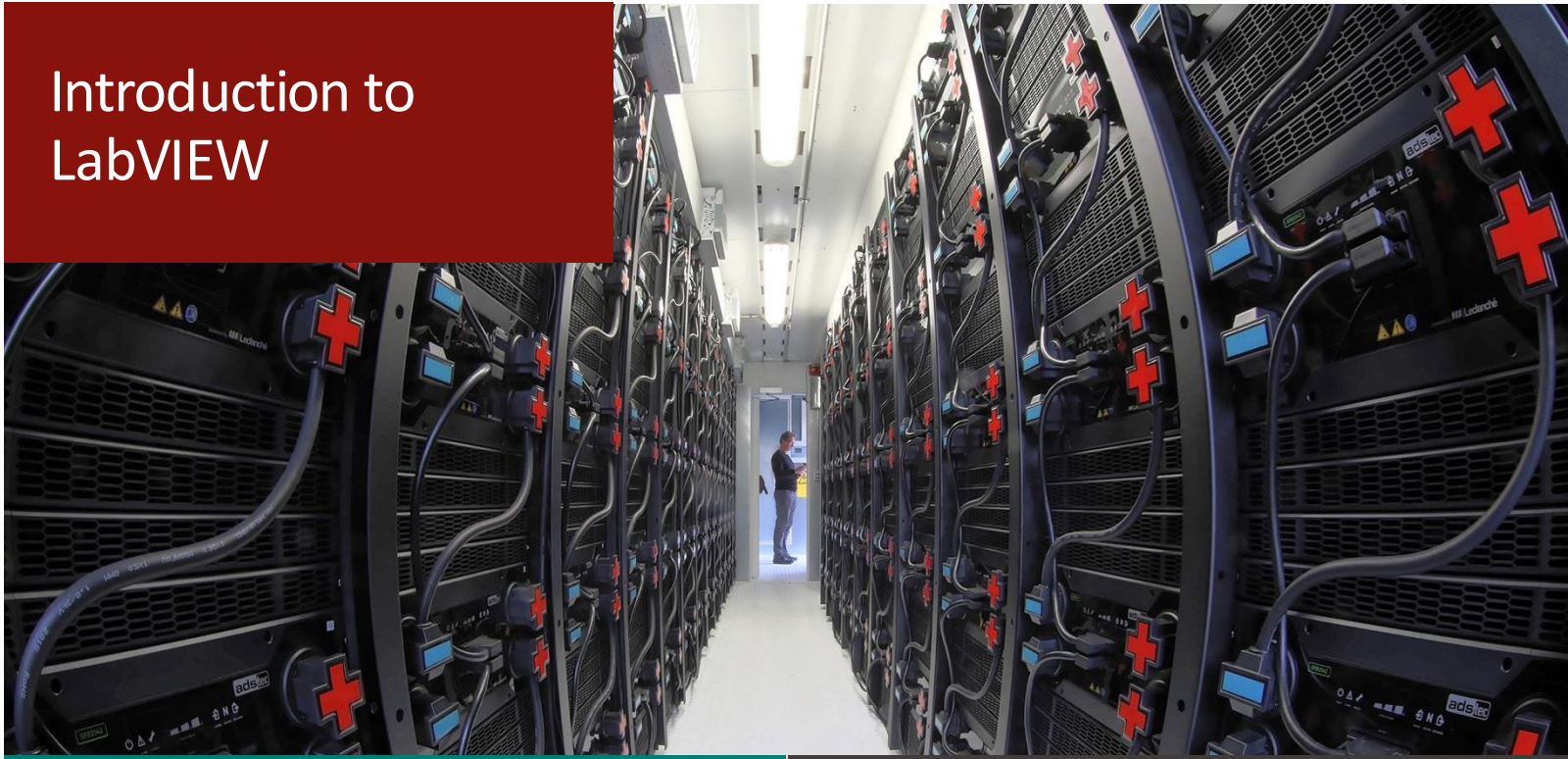
Introduction to LabVIEW



EE-472 Smart Grid Technologies

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Distributed Electrical Systems Laboratory

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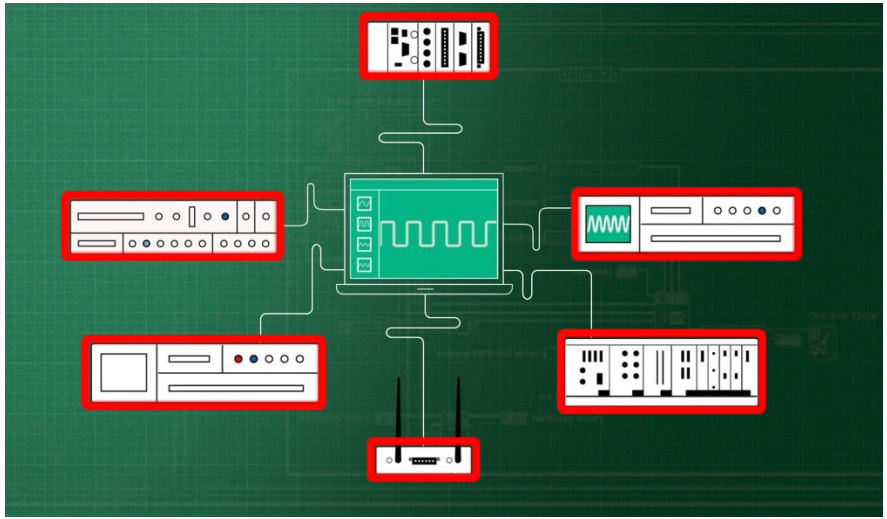
LabVIEW Introduction

- What is LabVIEW?
  - Visual programming language, called “G”.
  - Mainly used for:
    - Data acquisition.
    - Laboratory Instrument control.
    - Industrial automation.
    - Real time applications.
  - It allows for a fast integration of different subsystems in a single engineering application.

https://en.wikipedia.org/wiki/LabVIEW

LabVIEW Introduction

- Why do we use LabVIEW?
  - Fast and extensive hardware integration.
  - Lab instrumentation.
  - Data acquisition boards.
  - Telecommunications.
  - FPGA and real-time controllers.



LabVIEW Introduction

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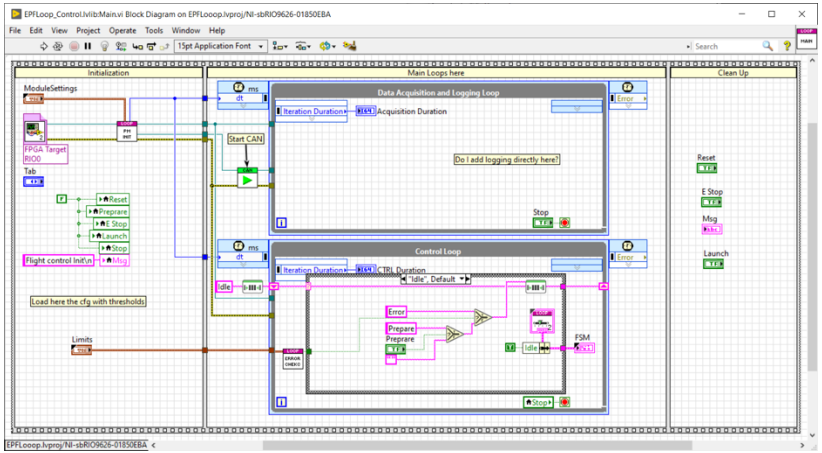
- Why do we use LabVIEW?
  - Graphical approach to programming.
    - “Code the way you think”.
  - LabVIEW recompiles the code at every action.
    - Errors are immediately spotted as they happen
  - It is suitable for parallel programming.
    - Multiple tasks at different rates.



Graphical Programming

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- Integration of user interfaces (front panels) into development cycles.
- Simply drag and drop virtual representations of lab equipment (oscilloscopes, probes,…)
- LabVIEW routines are called **virtual instruments (VIs)**
  - **Front panel:** user interface built with controls and indicators.
  - **Block diagram:** graphical source code. Environment where the programming happens.
  - **Connector pane:** representation of a VI in the block diagram of other calling Vis (sub VI).
- Data availability paradigm determines the execution flow.
- Inherently parallel execution of blocks of code.

Graphical Programming: Front panel

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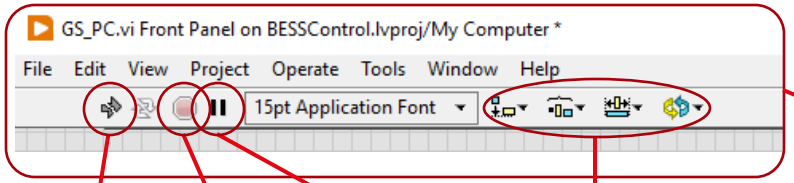
- User interface (UI). It is built from **controls** and **indicators**. They are the interactive input and output terminals of the VI, respectively.
- Controls and indicators can be found in the **control palette.**

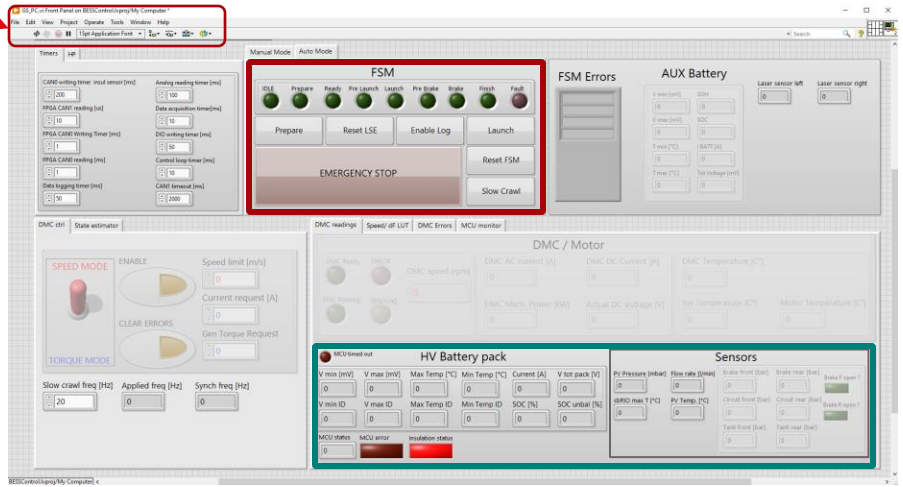


Run button

Pause button

Abort button

Arrange ctrls and indicators



Graphical Programming: Block diagram

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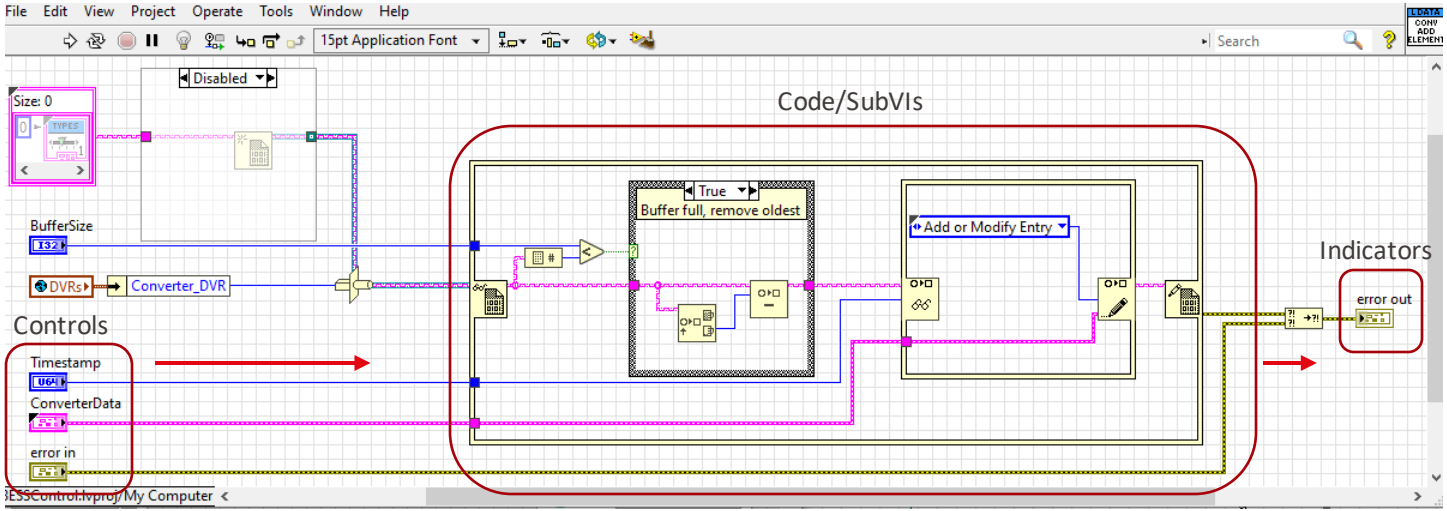
- Graphical **source code**. Where the developed software is.
  - Front panel objects appear as icon terminals on the block diagram.
  - Wires connect control and indicator terminals to functions and subVIs (Vis in a VI).
  - Data flows through wires: **from controls to VIs to indicators. Data availability paradigm**



Graphical Programming: Primitives

- LabVIEW provides a large library of different functions.
- They are in the so called “Function Palette”. Right click anywhere in the block diagram. The basic LabVIEW blocks are called “Primitives”.

Graphical Programming: Primitives

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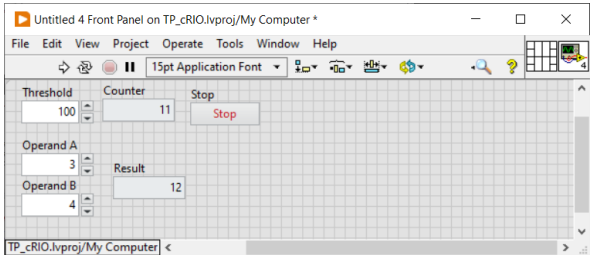

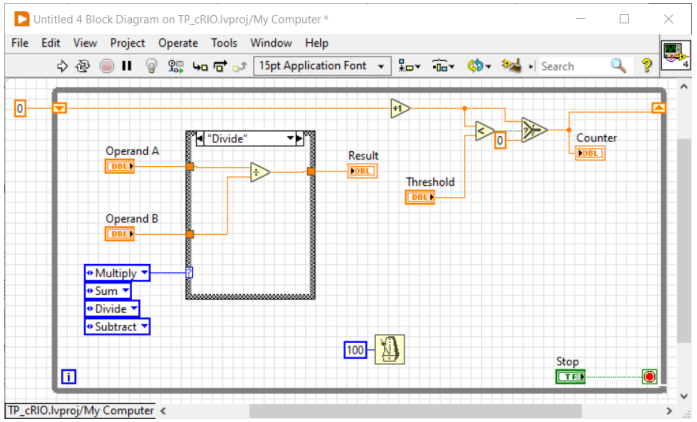

Graphical Programming: Help and Examples

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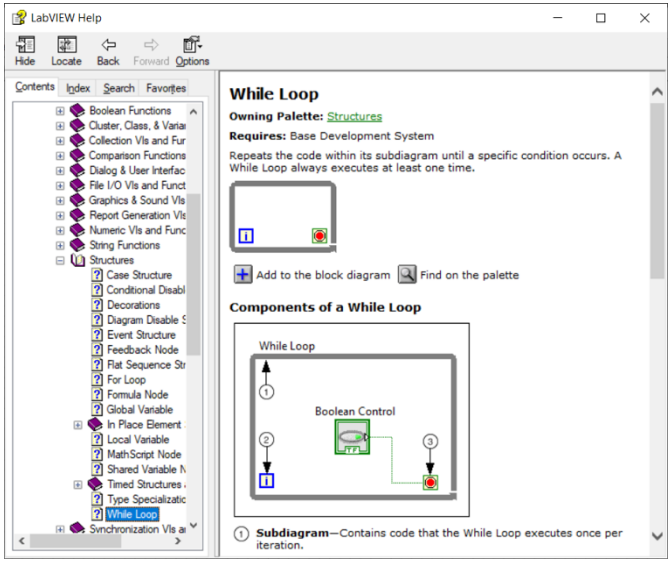
- Ctrl+H to open the help dialog.
- Hover above any block to display the Help context menu
- Many Examples are available to be used.



Graphical Programming: Connector pane

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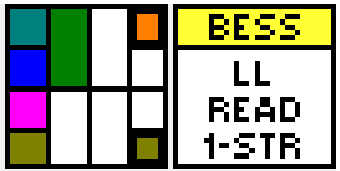
- Connection interface between different VIs running together in the same diagram.
- VIs that are called inside other VIs are referred to as **subVIs.**
- The connector pane represents the input and output configuration of the VI.



Graphical Programming: Connector pane

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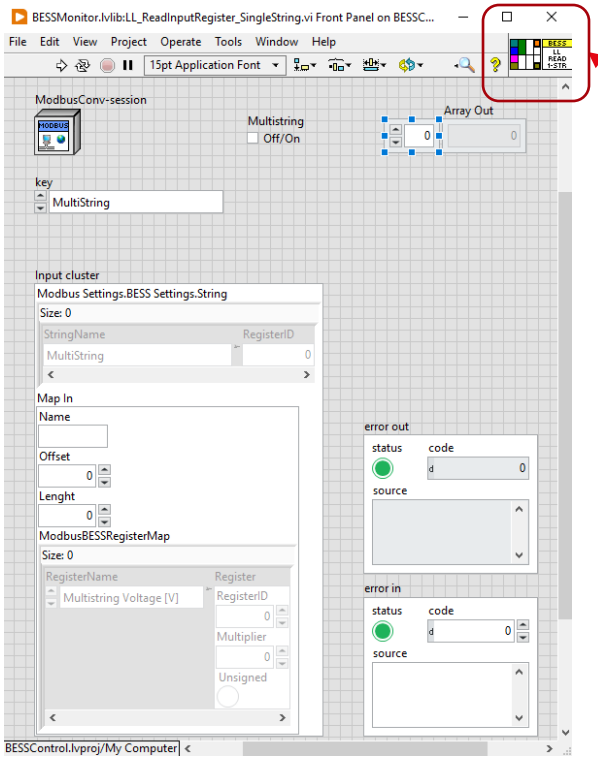
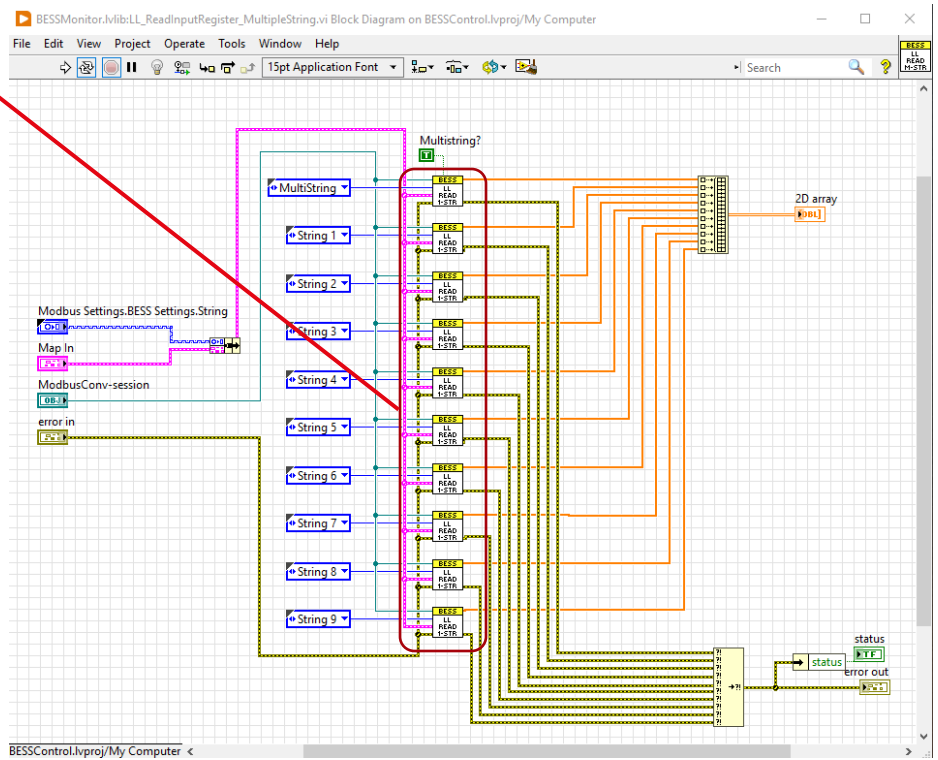
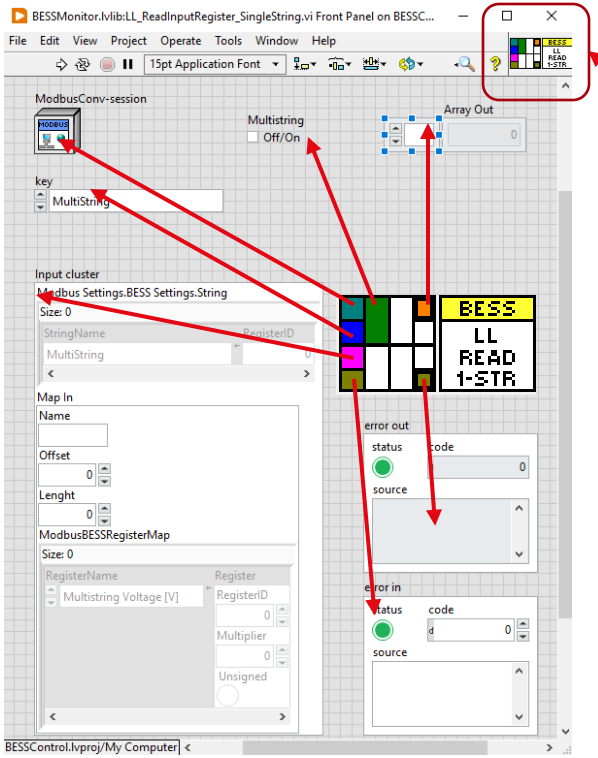
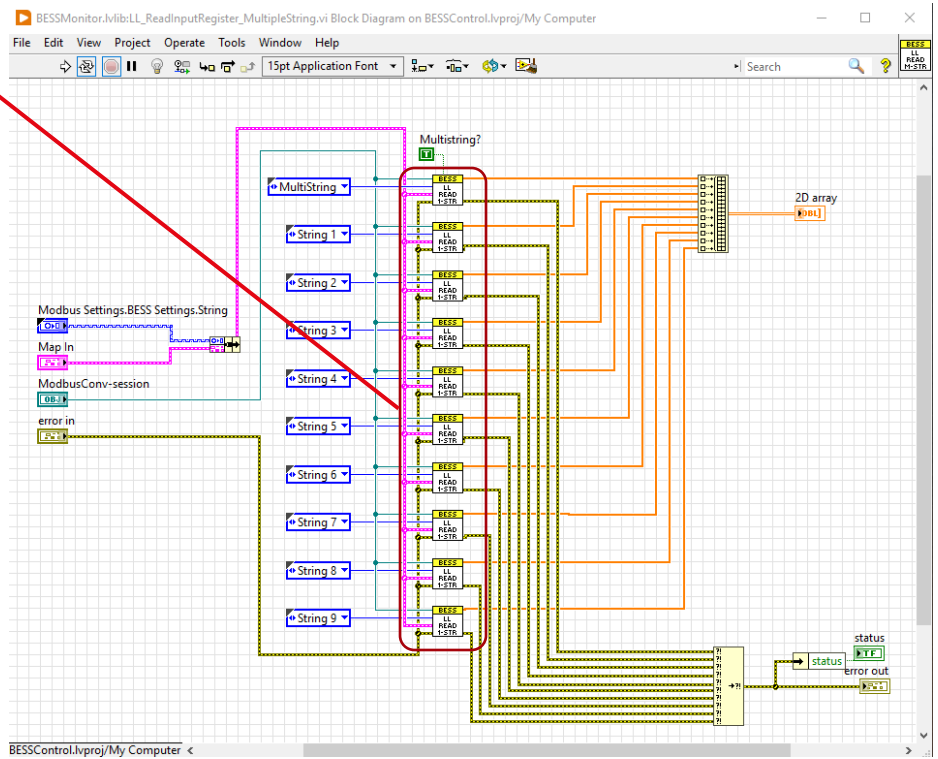




Graphical Programming: Connector pane





Exercise 1

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Tasks:

1. Create an empty LabVIEW project
2. Add a new VI called “Structures.vi”. This VI is to get used to G environment and play with the different structures.
3. Add a **case structure** (Switch statement in MATLAB) that allows to switch between:
    1. **For loop**
    2. **While loop**
    3. **Timed loop**
4. Implement an Iteration counter for each different structure that highlight the main differences between them.