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Head Office  
Neptronic®  
400 Lebeau Blvd.  
Montreal, Quebec, Canada H4N 1R6  
Tel.: (514) 333-1433  
Fax: (514) 333-3163  
Toll Free: 1-800-361-2308

## It's all about organization

### Control Wiring Basics

This month's Techttime covers the information required to be able to wire various equipment to our controllers. Before proceeding, remember that Neptronic controllers are configurable, which means two things:

1. Even though the device is connected to the right type of input or output, this does not mean that it is the correct configuration.
2. If the configuration you are looking for does not exist, it will most likely not work properly.

Before even thinking of wiring the devices to the controller, you should always make a list of the equipment, type, function and the signal used. This information will be required when calling for technical support.

For example;

- Equipment: Duct Heater
- Type: Output
- Function: Heating Ramp
- Control Signal: 0-10Vdc

*Note that valves can be direct or reverse acting. This information is very important since not all controllers have the ability to reverse the signal. This issue could be solved by using an external relay if the controller is already installed.*

The same applies to sensors, transducers, and relays;

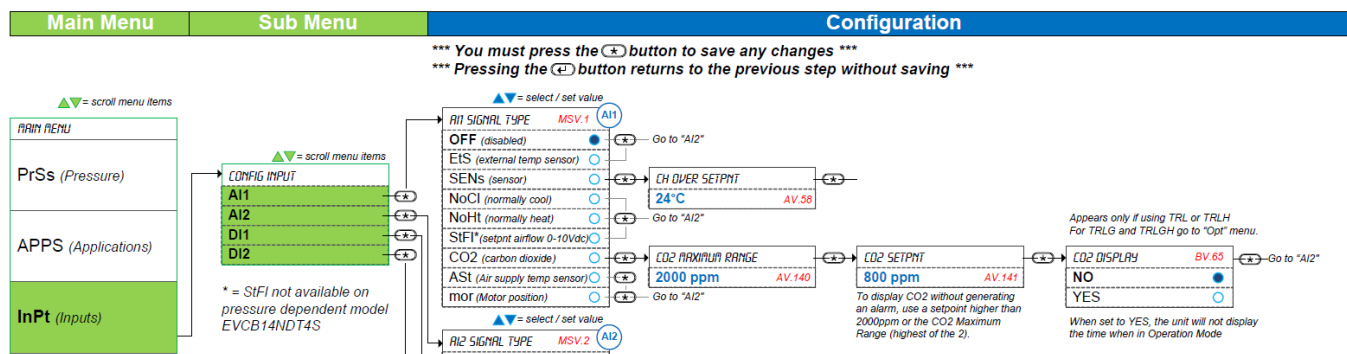
- Equipment: STC8-11 temperature sensor
- Type: Input
- Function: Changeover
- Control Signal: 10kΩ type 3

**USA**  
NEP Inc.  
P.O. Box 1151  
Medford Oregon,  
USA 97501  
Tel.: (541) 531-5746

**Middle East & Asia**  
NEP International FZE  
P.O. Box 125687,  
Dubai, UAE  
Tel.: +97155 8825487  
Fax: +9714 3426772

**Singapore**  
Neptronic Pte Ltd  
Office D6, #03-38,  
Mountbatten Square  
229, Mountbatten Road,  
Singapore – 398 007  
Mobile: +65 8118 4184  
Tel: +65 6650 6212  
Fax: +65 6491 6423

Once the equipment list is completed, you must refer to the Specification & Installation instructions to identify the possible terminals to be used. This document details the default configurations of the controller and the specific order in which they should be programmed. Sometimes, we can find a preconfigured input or output that matches the equipment requirements. This step allows us to reduce configuration time for the client. If there are no defaults available, then identify which terminal you will be using for the device.



## Note concerning the Commons

All of the equipment that needs to be wired requires at least two wires; common & signal. The common is the base or reference for the control signal. When you have multiple devices on the same controller, it is important that the common is the same for all. This is why we often recommend grounding the neutral leg of the transformer. This is especially true when multiple transformers are used on the same controller or multiple controllers connected together for a specific function, such as night setback.

When the transformer's neutral is not grounded (also referred to as a "floating transformer"), it is possible for the common to have residual charge. This residual charge will influence the signal sent to the devices from the controller. The voltage sent from the controller will not be the same as the voltage measured at the device terminal strip. **Note that all the commons on the Neptronic controllers are all internally linked together. Applying a voltage on one common will affect the entire controller's behavior.**

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## Signal

Analog signals are influenced by external power sources such as light ballasts and variable frequency drives (VFD). Staying away from these electrical fields is important. If you believe there might be some electrical interference, a shielded wire can be used. Digital (Binary) signals are also affected, but not enough to make any significant difference.

## Types of Inputs & Outputs

Digital or Binary Input (DI/BI): This type of input can be used as a dry contact (voltage free) or a wet contact (24Vac contact). It can be configured as a changeover switch, occupancy or night setback contact. Some controllers offer safety options such as airflow switch, door/window contact and a dirty filter switch. Controller override and heat override are some of the new features found on the second generation EVC and EFC controllers.

Analog Input (AI): This type of input can be configured as temperature (external/remote, discharge and/or changeover). On some models, CO<sub>2</sub> and humidity sensors may be available. All of our controllers use a 10kΩ type 3 or G thermistor for temperature, and some models can accept 0-10Vdc signals.

Universal Input (UI): This type of input can handle multiple signals. It can be configured for thermistors, modulating 0-10Vdc or it can be a binary contact.

Digital or Binary Output (DO/BO): This type of output is used with On/Off signals and stage control. It can be configured for heating and/or cooling but can also be used for fan speeds and On/Off humidifier.

Analog Output (AO): This type of output is used when with modulating signals such as 0-10Vdc or 2-10Vdc. It can be configured for heating and/or cooling but can also be used for ECM fan speed modulation and humidifier control.

TRIAC Output (TO): This type of output is used with On/Off or pulse signals as well as staged control. It can also be used with floating signals which is a form of On/Off to simulate a modulating signal. They can be configured as heating and/or cooling but can also be used for fan permission or start/stop.

## Other Device Power Supply

Some equipment may require an additional wire to power up the device. Depending on the model, the 24Vac power supply can be from the controller board or connected to the transformer directly.

### Power from the controller board

Advantage: Usually simpler to connect since the terminal strip is already present (control board).

Disadvantage: The traces on the controller's printed circuit board limit the amount of Volt-Ampere (VA) available and may not be sufficient for the device.

### Power from the transformer

Advantage: The amount of Volt-Ampere (VA) available only depends on the transformer size. If the transformer has enough capacity, it will work.

Disadvantage: The addition of a terminal strip is required to make the distribution possible.

## Wire Gauge

The wire gauge for controls is found on the specification sheet of the controller.

### Power wiring

- 18 AWG (0.8 mm<sup>2</sup>) minimum
- Binary signals maximum length is 300' (90m)
- Analog signals maximum length is 100' (30m)

### Thermostat to Controller (EVCB & EFCB series)

- 3 wire connection 18 AWG (0.8 mm<sup>2</sup>) minimum
- Maximum 50ft (15m) between controller and thermostat

### BACnet/Modbus Communication

- 24 AWG twisted-shielded cable (Belden 9841 or equivalent).
- Maximum network length 4000' (1200m) (*Refer to the BACnet Guide available on the Neptronic website*)

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