X13s

Thermocouple Expansion Module

USERS MANUAL

Revision 1.1

For models: X-13s

2-Channel Input Module for Thermocouples

- **Monitor tank temperatures**
- **Monitor oven temperatures**
- **Refrigerator & Freezer monitoring**
- **Monitor temperatures in industrial environments such as:**

  Test chambers, steam plants, boilers, autoclaves, ice machines, and more...

CONTROL by WEB™
www.ControlByWeb.com

a division of Xytronix Research & Design, Inc.
located in Nibley, Utah, USA

X-13s User Manual Revisions	
Revision	**Description**
1.0	Initial release
1.1	Clarified power requirements

Section 1: Introduction

The X-13s™ Thermocouple expansion module is used in conjunction with the X-600M™ controller. The X-13s is a 2-channel signal conditioner for Type-K thermocouples. One or more X-13s thermocouple expansion modules can be connected to a X-600M control module with a ribbon cable. The ribbon cable provides both power and communications to the module.

The X-600M is a multifunction web-enabled industrial I/O controller. It performs control, logic, and monitoring functions similar to that of a Programmable Logic Controller (PLC). However, unlike a PLC, the X-600M is designed for web-based applications from the ground up. No add-on software or hardware is required. The X-600M can be fully configured, programmed and tested using its built-in web server. The web setup pages are intuitive and easy to use and do not require special programming skills.

The X-600M together with the X-13s provide an easy, flexible and reliable way to monitor temperature over a network. The X-13s is suitable for use with freezers, ovens, fermenters, generators – anywhere precision, rugged, temperature sensors are required.

1.1 Advantages of Thermocouples

Thermocouples are used extensively in the scientific and automation industries. Thermocouples are available in a wide variety of industrial housings, including thermowells, threaded wells, PFA coated thermowells for corrosive applications and high temperature lead wires. Thermocouples have a much wider range than with the “1-wire” digital sensors (-55°C to 125°C) supported by the X-600M. Thermocouples are workable in high temperature applications such as in a fermenter where steam is injected to sterilize the vessel.

Temperature Range: Type-K thermocouples have a measurement range of -200°C to +1250°C

Robust: Thermocouples are inexpensive, extremely simple, and rugged devices which are suitable for use in hazardous environments.

Rapid response: Because they are small and have low thermal mass, thermocouples respond rapidly to temperature changes.

No self heating: Thermocouples require no excitation power; therefore, they are not prone to self heating.

1.2 Connectors & Indicators

Thermocouple Inputs

The X-13s is a 2-channel input module for use with Type-K thermocouples. The X-13s has built-in miniature thermocouple connectors together with a precision cold-junction temperature compensation circuit. The cold junction compensation is accurate to +/-0.5°C from -40°C to 85°C. The X-13s only works with ungrounded or isolated thermocouples.

Expansion Bus

The expansion bus allows for a family of expansion modules to be connected directly to the X-600M without the need for an Ethernet switch. The cable can be a daisy chain with multiple connectors. The ribbon cable expansion bus provides both power and communications connections.

Power Supply

The expansion bus can provide up to 1.7 Amps for powering up to 32 expansion modules; however, the maximum number of expansion modules depends on the module type and power source attached to the X-600M.

The X-13s employs modern switch-mode power supply. With this type of power supply the current draw decreases as the voltage increases; therefore, you can add more expansion modules by using a 24-volt power supply than you can with a 12-volt power supply. See the *X-600M User Manual* for more details.

Indicators

The green Power LED indicator is illuminated whenever the module is powered. To identify the module during installation, the X-600M can send a blink command which will cause the power LED to blink for three seconds. The two yellow LEDs indicate the status of the thermocouple inputs and are illuminated if the respective thermocouple is open or the lead wire is disconnected.

1.3 Part Numbers and Accessories

Device	Description	Part Number
X-13s	Thermocouple expansion module with two thermocouple inputs.	X-13s-K

Section 2: Installation and Connections

Installation consists of mounting the X-13s™ and connecting it to an X-600M controller with a 10-conductor ribbon cable. Programming and testing is done by using a web browser to configure the web pages, inputs, and outputs for your specific needs.

2.1 Installation Guidelines

- This unit must be installed by qualified personnel.
- This unit must not be installed in unprotected outdoor locations.
- This unit must not be used for medical, life saving purposes, or for any purpose where its failure could cause serious injury or the loss of life.
- This unit must not be used in any way where its function or failure could cause significant loss or property damage.

2.2 Mounting

X-13s can be mounted to a standard (35mm by 7.55mm) DIN-Rail. Normally expansion modules are mounted to the left side (embossed logo side of the enclosure) of the X-600M controller so that the ribbon cable doesn't cover the power connector. The X-13s should be located in a clean, dry location where it is protected from the elements. Ventilation is recommend for installations where ambient air temperatures are expected to be high. See *Appendix D: Mechanical Information* for additional mechanical details.

2.2.1 DIN-Rail Mounting

Attach the X-600M to the DIN-Rail by hooking the top hook on the back of the enclosure to the DIN-Rail and then snap the bottom hook into place. To remove the X-600M from the DIN-Rail, use a flat-head screwdriver. Insert the screw driver into the notch in the release tab and pry against the enclosure to release the bottom hook.

Section 3: Example Applications

Environmental Monitor

The X-13s can be used for a broad range of temperature sensing applications. The web interface and the built-in control capabilities of the X-600M can be leveraged to operate alarms or provide input to process control or security systems. The X-600M can operate without being connected to a PC or server, it can operate alarms, equipment and controls in remote locations based on the temperature, event schedules or other inputs. The X-600M can display data from multiple X-13s expansion modules.

Process Control

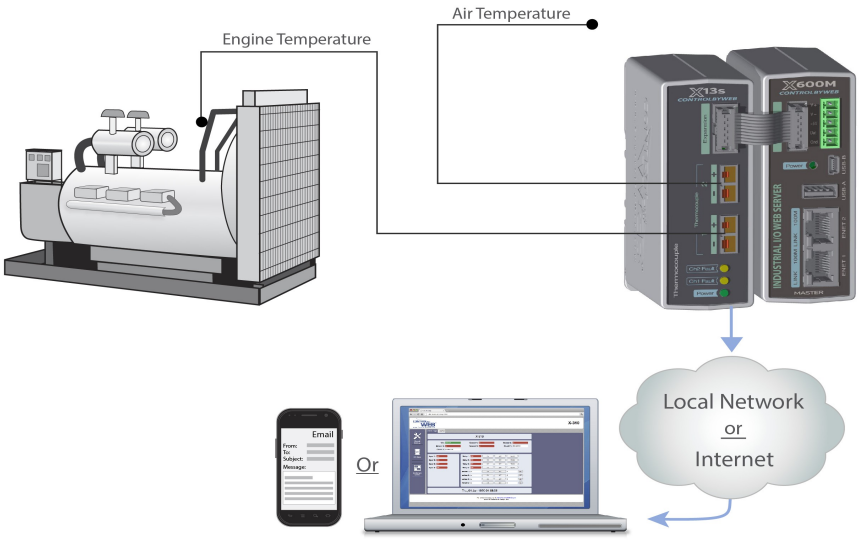
Together with the X-600M controller, the X-13s may be suitable for process control applications where a PLC is traditionally used or to augment the capabilities of a PLC. Not only is the X-600M more economical than a PLC, the ease of programming reduces deployment and configuration maintenance costs. The Modbus/TCP interface can be used to transmit temperature data to other devices, including PLCs.

Process Monitor

The web page display can be customized to provide temperature data formatted for your needs. Email, SNMP, XML, and Modbus/TCP alerts can be generated automatically when a process' parameter limits are violated or interrupted.

3.1 Monitor the temperature of a generator

In the example below, thermocouples are used to monitor the engine coolant temperature and the ambient air temperature of a generator. If the temperature exceeds a user-specified threshold, an email or text notification is sent to the appropriate personnel notifying them of the alarm condition.



Section 4: Configuration and Setup

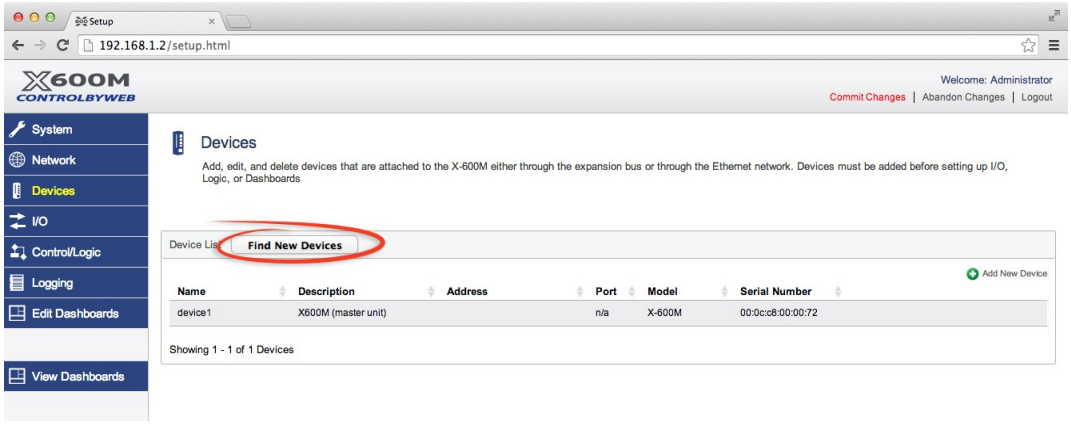
4.1 Setup Example

The Quick Start Demo

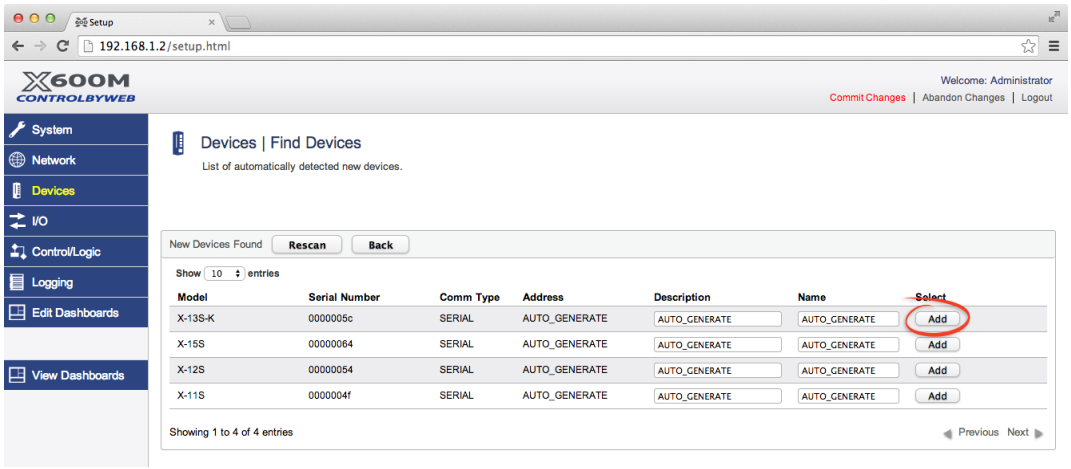
After making the power and Ethernet connections, the X-600M can automatically scan for the presence of any ControlByWeb™ Ethernet devices (on the same sub-net) and also for any expansion modules connected to the X-600M via the ribbon-cable connector. It also automatically creates a dashboard web page and populates it with all of the resources (components) supported by the Ethernet devices and expansion modules. This makes it easy to start experimenting with the web page's user interface and to try out the relays and sensors.

To quickly add a device do the following:

1. Click on the **Devices** menu tab to pull up the *Devices Overview* page. Then click on the **Find New Devices** button to scan the expansion bus and the local network for ControlByWeb devices and expansion modules.

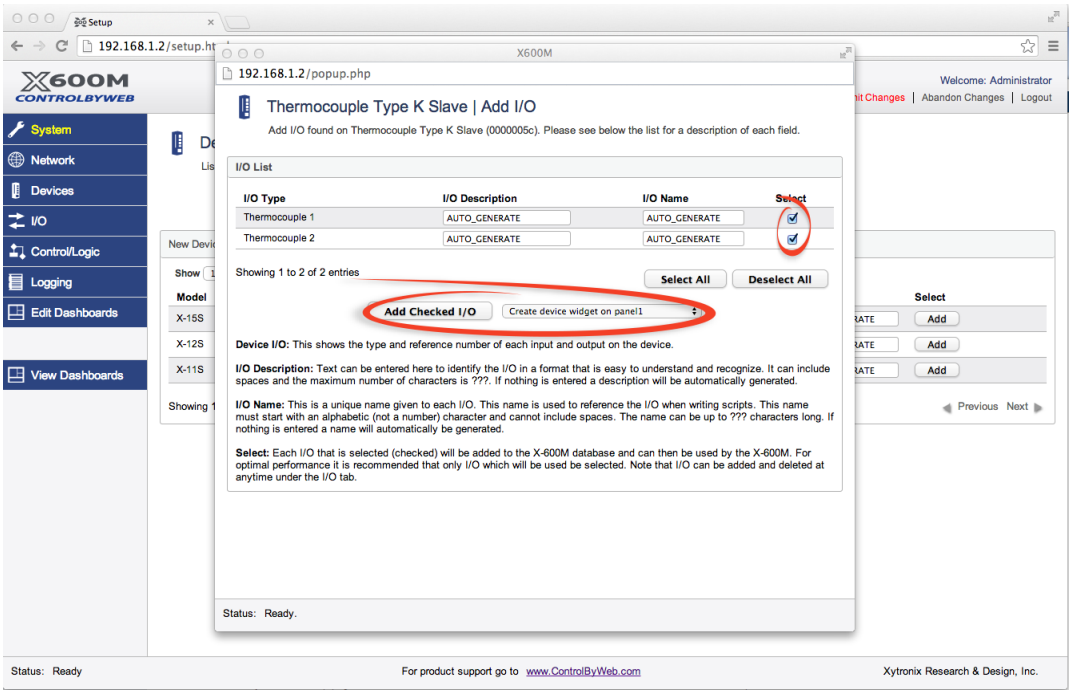


2. In this example we are going to add an *X-13s Thermocouple expansion module*. Click the **Add** button for the X-13s.

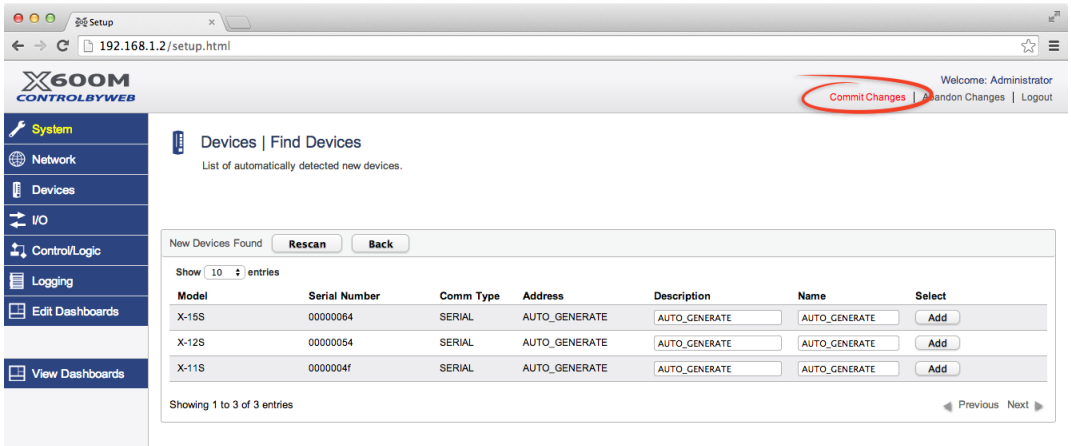


3. In the *Select* column, click the checkboxes of the I/O components you would like to configure and select the **Create Device Widget** checkbox (This will display the status of the I/O on the Dashboard).

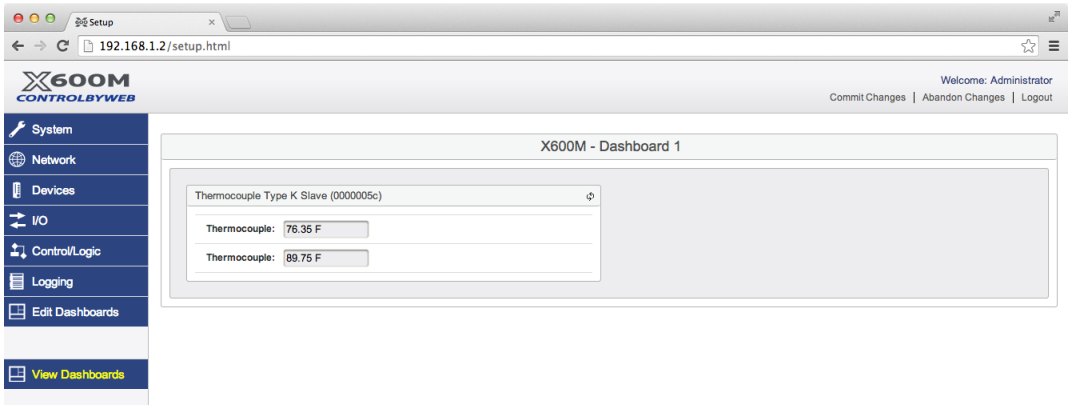
Click **Add Checked I/O** to submit these changes.



4. Click **Commit Settings** - Once clicked, the X-600M begins to monitor the newly added device.



5. On the main menu, click the **View Dashboards** menu tab. The **View Dashboards** page shows a display similar to what users will see when accessing the X-600M's control page. A temperature readout should be shown for both sensor channels. Use this page to test and debug the dashboards, panels, widgets and components in real time. A pull-down menu allows access to other dashboards. Within minutes you can experience the power and flexibility of the dashboard's user interface and experiment/test the buttons, sliders, and data entry boxes to meet your needs for your specific application.



Appendix A: Specifications

Power Requirements

Input Voltage: 9-28 VDC (power is supplied via the X-600M controller, 24V recommended)
Current: See table below for typical values at 25°C

Power Supply	Input Current		
	Two Thermocouples (LEDs Off)	One Thermocouples (1 LED On)	No Thermocouples (2 LEDs On)
9 VDC	17 mA	34 mA	50 mA
12 VDC	13 mA	25 mA	38 mA
24 VDC	8 mA	14 mA	20 mA

Note: *For solar powered applications or where low current operation is important, install two thermocouples or a wire jumper on the unused channel to keep both open thermocouple error LEDs off.*

Thermocouple Inputs

Number of channels:	2-channels
Thermocouple:	Type-K
Linear Range:	-200° C to 1250°C
Operating Ambient:	-40° C to 85°C (internal cold junction compensation)
Resolution:	0.027°C
Accuracy:	+-0.5°C
Drift:	4ppm/°C typical, 15ppm/°C max
Type:	Inputs are not isolated, only use ungrounded thermocouples
Input Current:	Differential, +-165nA max
Error Detection:	Detects sensor breakage or disconnection of lead wire

Thermocouple Connectors

Type:	Miniature size, Omega PCC-SMP Series, Type-K
Mating Connector:	Miniature size, SMP

Expansion Connector:

Connector:	Ribbon cable, 2x5-position, polarized 0.100” pitch
Communications:	RS-485

LED Indicators

Green:	Power On
Yellow:	“Open Thermocouple” Channel-1
Yellow:	“Open Thermocouple” Channel-2

Environmental

Indoor use or NEMA-4 protected location

Altitude:	up to 2000m
Operating Temperature:	-40ºC to 65.5ºC (-40ºF to 150ºF)
Storage Temperature:	-40ºC to 85ºC (-40ºF to 185ºF)
Humidity:	5-95%, non-condensing

Mechanical

Size:	1.41 x 3.88 x 3.1 in. (35.7 x 98.5 x 78 mm), (not including connector)
Weight:	4.8 oz (136 g)

Electromagnetic Compliance

IEC CISPR 22, CISPR 24
FCC 47CFR15 (Class B)
EN55024 ITE Immunity (2010)
EN55022 Emissions (2010)

Product Safety Compliance

UL 61010-1 (Electrical Equipment for Measurement, Control, and Laboratory Use)

CE

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LISTED
PROCESS CONTROL EQUIPMENT
E468316

Appendix B: Trademark and Copyright Information

Appendix C: Warranty

This Xytronix Research & Design, Inc. product has a warranty against defects in material and workmanship for a period of one year from the date of shipment. During the warranty period, Xytronix Research & Design, Inc. will, at its option, either repair or replace products that prove to be defective. This warranty is extended to the original purchaser of the equipment only.

For warranty service or repair, the product must be properly packaged, and returned to Xytronix Research & Design, Inc. The purchaser shall prepay all charges for shipping to Xytronix Research & Design, Inc., and Xytronix Research & Design, Inc. will pay the shipping charges to return the product to the purchaser as long as the product is shipped within the United States. If the product is shipped outside of the United States, the purchaser shall pay all shipping charges, duties, and taxes.

Limitation

The foregoing warranty shall not apply to defects or damage resulting from improper use or misuse, unauthorized repair, tampering, modification, improper connection, or operation outside the electrical/environmental specifications for the product. Further, the warranty does not cover Acts of God, such as fire, flood, hurricanes, and tornadoes. This warranty does not cover damage to property, equipment, direct, indirect, consequential, or incidental damage (including damage for loss of business profit, business interruption, loss of data, and the like) arising out of the use or misuse of this product.

UNDER NO CIRCUMSTANCES WILL THE LIABILITY OF XYTRONIX RESEARCH & DESIGN, INC. TO THE PURCHASER OR ANY OTHER PARTY EXCEED THE ORIGINAL PURCHASE PRICE OF THE PRODUCT, REGARDLESS OF THE FORM OF THE CLAIM. No other warranty is expressed or implied. Xytronix Research & Design, Inc. specifically disclaims the implied warranties or merchantability and fitness for a particular purpose. Some jurisdictions may not allow the exclusion of limitation of liability for consequential or incidental damage.

Appendix D: FCC Statement

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference.
- This device must accept any interference received, including interference that may cause undesired operation.

Warning

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause interference to radio communications. There is no guarantee, however, that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into a relay on a circuit different from where the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Notice

Changes or modification not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.

Appendix E: Mechanical Dimensions