Controls Guide for XeteX Units

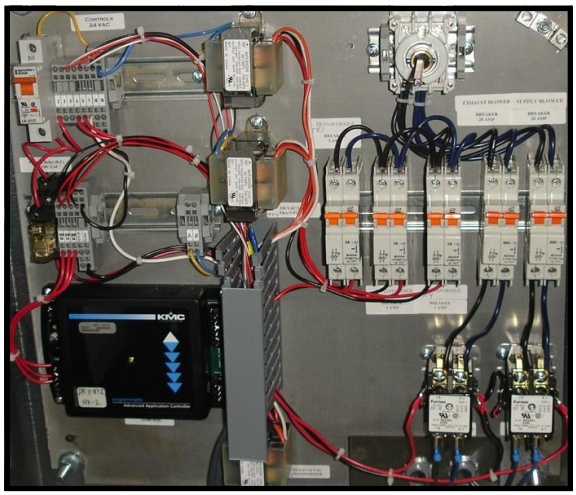
Beyond meeting the typical specification and performance requirements, controlling the equipment is usually the most important success factor for HVAC projects. XeteX provides the broadest-possible array of control options. From fully-preprogrammed, native BACnet, complete control packages to stand-alone analog systems, XeteX can provide controls to do just about anything and work with just about any building management system. This unsurpassed level of flexibility means that the full line of XeteX units can meet any controls challenge.

Features and Benefits of XeteX Controls

Flexibility is a principle advantage of XeteX controls. All units come with standard control options, but custom controls can also be designed and provided to meet any requirement. XeteX can also install customer-provided controls or ship the unit with no controls, ready for configuration by a controls contractor. These options allow the customer to choose whatever controls are best suited and most economical for them.

Energy Recovery Functions

When XeteX provides controls, three energy recovery functions are usually included. These standard functions are Frost Control, Economizer, and Cooling Mode. During winter conditions, the Frost Control function prevents condensation in the exhaust airstream from freezing in the heat exchanger and constricting airflow. In the spring and fall, the Economizer mode ensures that an excess of energy is never recovered which would otherwise overheat the space. And the Cooling Mode function ensures that maximum energy is recovered during summer conditions when the exhaust air can be used to pre-cool the supply air.



An XeteX Control Panel with DDC Board

Other Unit Control Functions

Some XeteX units are supplied with "keep it simple" controls that just open and close dampers and modulate blower speed. Others implement some control logic that maintains a few user-defined supply air set points. Sometimes these simple systems are either by themselves enough to satisfy the project requirements or they provide a sufficient basis for Controls contractors to install more sophisticated systems at the job site.

More often, however, XeteX provides a full controls package, with systems that intelligently monitor and regulate all active unit components. Air conditioning equipment such as heating, cooling, and humidifying elements, as well as air volume, damper position, reheat configuration, and all other unit operations are controlled to maintain specific supply air conditions according to an adjustable

user-defined schedule. The system can also monitor variables such as filter pressure drop, smoke alarm status, and other parameters and communicate with a building control network (e.g., a BACnet system) to keep building managers informed about the unit's condition.

XeteX Standard Control Options

Although XeteX has the flexibility to provide all types of specified control systems and methods, a standard set of control options has been developed. Through many years of experience, these standard control options have proved to be the most reliable and effective.

Component Control Devices

The schematic on the following page shows a wide range of components routinely provided in XeteX units (some less common ones are not shown). The standard devices and systems XeteX uses to control these components, as well as the types of sensors used to monitor system conditions, and different standard human or building control system interface options can be read from this schematic. (This schematic illustrates the standard controls applied to a wide variety of XeteX unit options. For purposes of illustration, a large number of unit components are shown—it does not reflect a realistic design for a single unit.)

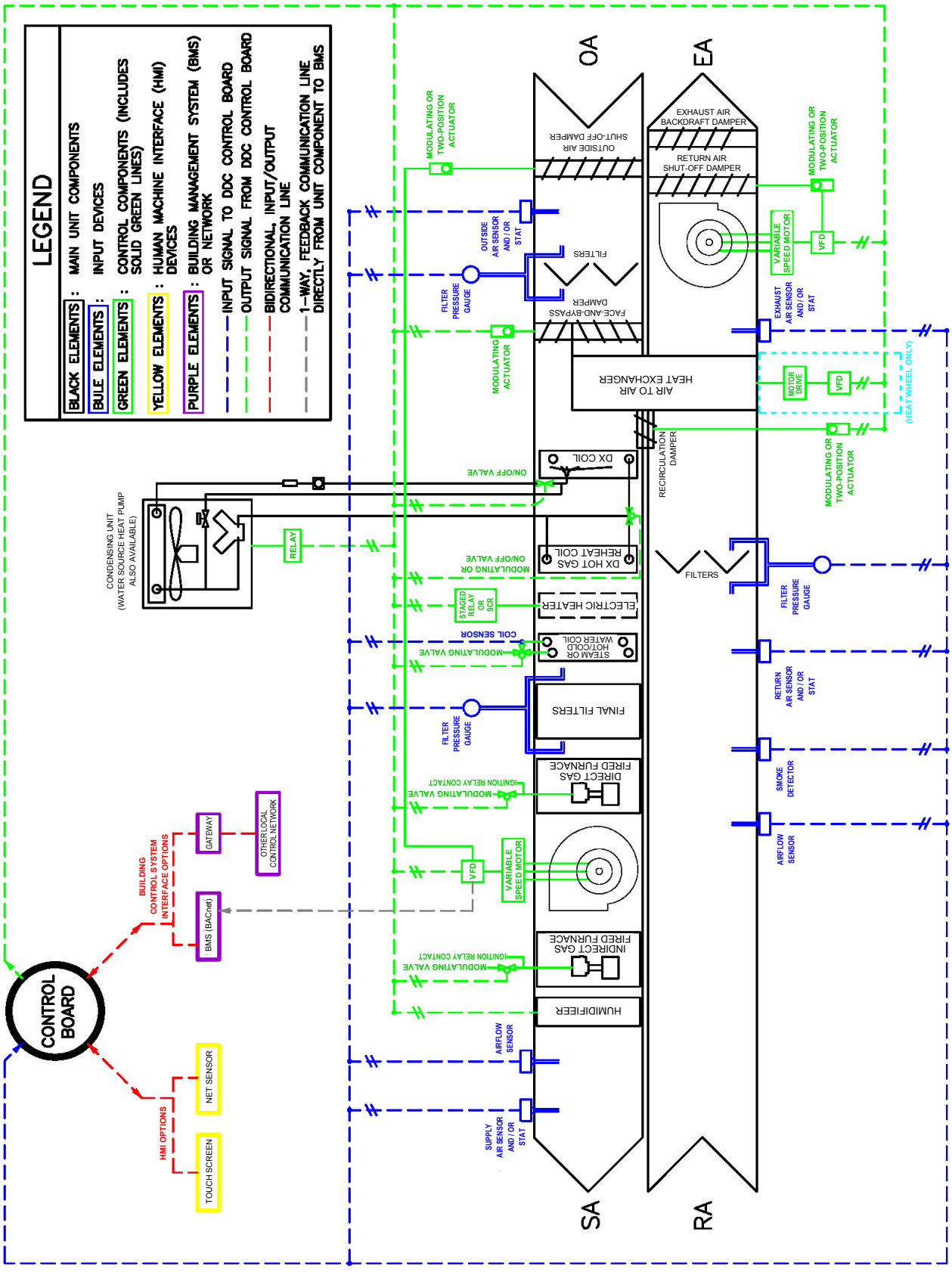
The schematic depicts a system with a full controls package, as described above. In such packages, the central control functions are carried out by a controller ("Control Board"). Inputs to the controller include temperature, humidity, pressure, and signals from other various sensors. The controller can monitor the inputs, output information to an interface or building network, apply control logic, and make real-time adjustments to unit component operation. If, for example, a sensor indicates that the conditions of the air on the exhaust side of a flat plate heat exchanger are approaching freezing, the controller will signal an actuator to partially open a bypass damper (e.g., to 10% open) in order to maintain an exhaust air temperature above 32 °F and prevent frost from forming. Or, if a sensor indicates that the temperature in the air conditioned space has dropped below a certain set point, the controller will open the modulating valve on a hot water coil.

Controls for a DX compressor system including Compressor Motor Contactors and Starters and Timed Relays

If, however, these standard control options are not able to satisfy some particular job requirement, XeteX can custom design a system that will meet almost any specification. In such a case, XeteX can supply and install a portion of, or the entire control system.

Controllers

Although the schematic on the next page shows the standard devices used to control the most common kinds of XeteX unit components, it only shows one type of controller—a control board. Other options are available. The two basic types of controllers are Analog Stats and Direct Digital Control (DDC) Control Boards.

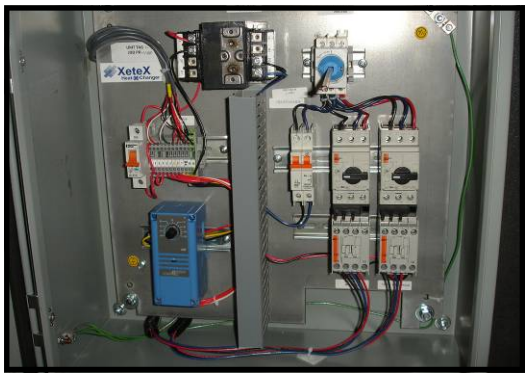


Analog Controls

Analog controls are the simplest type of controller option. They consist of one or more stats that can output a control signal usually based on whether an input from a single sensor is less than or greater than an adjustable set point. If, for example, a stat senses that the supply air temperature rises to more than 60 °F, it will shift the unit into Economizer mode by powering the face-and-bypass damper to the bypass position.

Dials on the stats allow the user to adjust a variety of set points so changes to control functions can be made in the field. The temperature at which the face-and-bypass damper enters Economizer mode, for example, can be changed from the factory-set default of 60 °F. And Analog Controls are generally easy to configure. Although their set points are adjustable, once installed they require no attention—they are a "set it and forget it" control solution.

Although easy to use, the simplicity of Analog Controls limits their capability. They have only one input and one output and they cannot be programmed to apply more than one function or implement logic based on more than one variable. One stat cannot, therefore, be used to independently control more than one function on any single component. Separate stats, for example, would be required to implement Economizer and Frost Control functions even if both are accomplished with the same face-and-bypass damper. While use of multiple stats can therefore be a simple and economical off-the-shelf solution, more sophisticated controllers are usually required for units with more than a few components.



An XeteX Control Panel with Analog Controls (the blue stat appears on the lower left side).

Digital Controls

XeteX preprogrammed, integral, Stand Alone DDC control boards have the capability to control more complex unit operations. These boards are fully programmable and have multiple inputs and outputs. They can apply logic based on signals from sensors in the unit and in the air conditioned space and use them to control all unit functions and components. They can also use the signals from various sensors (e.g. smoke detectors) to activate alarms or display other information on component or overall unit status.

Instead of adjusting the operation of individual unit components, DDC controllers allow the user to simply make schedules of desired supply air conditions. The pre-programmed control board then directs all the unit components to perform the operations necessary to achieve that result. If, for example, the controller receives a signal from a thermostat in the building indicating that the space temperature has dropped below a user-defined and adjustable set point, it will automatically open outdoor and exhaust air dampers, start blower motors, adjust the face-and-bypass damper to the correct Frost Control position, and open the modulating valve on a hot water coil to provide the correct amount of heat.

Like analog controls, DDC control boards allow users to adjust a variety of set points. Unlike a system of several stats, however, all set points for a DDC control board can be adjusted from a single interface which can be mounted remotely.

The standard XeteX DDC controller can also be used with a Building Management System (BMS). These boards are native BACnet and MS/TP (Master Slave/Token Passing) compliant. Although they can be used as stand-alone boards without a BMS, they have the capability to communicate with—and be controlled by—any BACnet network, receiving commands and sending information about alarm, component, and unit status.

The BACnet DDC controller has Ethernet and RS–485 connection ports. These ports can also be used to connect to other types of local control networks if appropriate gateways are used.

Human Machine Interfaces

Human Machine Interfaces (HMIs) are used with DDC controllers. They allow users to communicate directly with the program on the control board without going through a control network—in other words, they allow walk-up control to be performed at the unit. For stand alone DDC boards, some type of HMI is required, otherwise it will be impossible to interface at all with the controller. If a BACnet DDC control board is used with a BMS, an HMI may still be used, but is not required—users can interface with the controller via the BMS.

XeteX can provide an easy-to-use, panel-mounted, touch-screen HMI which allows great flexibility in changing operating parameters (e.g., opening valves, closing dampers), adjusting air condition set points and other control program variables, or executing schedules.

A simpler HMI option that XeteX can provide is a Net Sensor, which allows users to change air condition set points (allowing users to reprogram Frost Control, Economizer, and Cooling Mode functions) and check the conditions at different locations in the supply and return airstreams.

Net Sensor HMI

Touch Screen HMI

Mechanical Specification

Control Boards

A native BACnet, MS/TP compliant, pre-programmed, and adjustable DDC Control Board with both Ethernet and RS–485 communication ports shall be provided with the unit. The controller shall be provided with a pre-installed custom program developed for the specific requirements of each individual unit and application. All necessary sensors shall be provided. The controller shall be capable of monitoring the status of all sensors; communicating with a BACnet Building Management System (BMS provided by others) or, via a gateway, other local control networks (network and gateway provided by others); and controlling all components in the unit to provide supply air at the specified conditions. The program sequence shall incorporate Frost Control, Economizer, and Cooling Mode functions, and any other functions required or specified.

Analog Controls

The following electronic temperature controllers shall be provided: A proportional plus integral temperature controller equipped with user-selectable time integration constants, adjustable throttling, and adjustable setpoints. An on/off temperature controller with a single-pole/ double-throw relay output, a light emitting diode relay status indicator, and an adjustable differential and setpoint.

HMIs

Touch-Screen HMI: A panel-mounted Touch-Screen Human-Machine Interface (HMI) device shall also be provided with the unit and will allow users to change unit operating parameters (e.g., opening valves, closing dampers), adjust air condition set points (to reprogram Frost Control, Economizer, and Cooling Mode functions), execute schedules, and change other control program variables.

Net Sensor HMI: A panel-mounted Net Sensor Human-Machine Interface (HMI) shall also be provided with the unit and will allow users to change air condition set points (to reprogram Frost Control, Economizer, and Cooling Mode functions) and check the conditions at different locations in the supply and return airstreams.

Energy Recovery Control

Units with Heat Wheels shall come with factory mounted electronic speed control providing soft-start/stop, rotation detection and alarm, and self-cleaning jog functions. A DDC Control Package will include four temperature sensors (one for each air stream) and provide full temperature control with frost protection, economizer, and cooling mode functions.

Units with Flat Plate Heat Exchangers shall be provided with a Face-and-Bypass Damper and Modulating Actuator. A DDC Controls Package will include four temperature sensors (one for each air stream) and provide full temperature control with frost protection, economizer, and cooling mode functions.

Damper Control

Outside Air [and Exhaust Air] Shut-Off damper[s] shall be mounted on the inlet [and outlet] of the unit and operated by [modulating or two position], spring return, direct-coupled actuators with end switch[es] to be interlocked with the supply [and exhaust] air motor [relay or relays, respectively]. Actuators to be controlled by a DDC control board.

Face and Bypass dampers shall be provided with a modulating spring return actuator controlled by a DDC control board. Recirculation dampers shall be provided with a [modulating or two position], spring return actuator controlled by a DDC control board.

Blower Control

Blowers shall be provided with Variable Speed Motors and Variable Frequency Drives (VFDs) controlled by a DDC control board.

VFDs shall be UL listed as complete assemblies and be enclosed in enclosures that are UL listed as plenum rated. VFDs shall also have seismic certification. Drive-mounted digital displays and keypads shall allow operator interface and include Auto-Manual-Off speed control selections. Built in timers that use a real-time clock shall be included and eliminate the need for external timing circuits. VFDs shall also have serial communication ports with BACnet MS/ TP, Modbus, Johnson Controls N2, and Siemens Building Technologies FLN standard protocols and shall not require any third-party gateways.

VFDs shall provide a programmable loss-of-load relay/serial communication output to indicate a broken belt or coupling. A run permissive circuit shall delay motor operation until a dry contact has been closed indicating that the appropriate dampers are open. A minimum of two separate safety interlock inputs shall also be provided that, when opened, will cause the VFD to command the motor to stop and the damper to close. VFD shall also have a programmable time delay for motor start.

VFDs shall also incorporate two PID Set Point controllers allowing space pressure or flow signals to be connected to the VFD using the microprocessor in the VFD for closed-loop control. The second independent PID loop shall be capable of using an analog input to modulate an analog output to maintain the set point of an independent process (valve, damper, etc.). It shall be possible to monitor and control these processes through the serial communication port.

Circuit breaker, output contactor, bypass contactor, and fast acting VFD isolation fuses shall also be provided. The tolerated voltage window shall allow the VFD to operate from a line of +30% to –35% of nominal voltage range. VFDs shall be rated for continuous operation to 104 °F with full current without being compormised by temperature variations within any 24 hour period; at 122 °F only 10% de-rating shall be required. VFDs shall also include Electromagnetic Interference / Radio Frequency Interference (EMI/RFI) filters that meet product standard EN 61800-3 for the First Environment and therefore eliminate the need for any external filtering hardware. VFDs shall have internal 5% impedance reactors to reduce the harmonics to the power line and to add protection for AC line transients.

Air Condition Control

[Hot Water Coils, Cold Water Coils, and/or Steam Coils] shall be provided with a Coil Condition Sensor. A Modulating Valve shall be provided [by others or by XeteX] and controlled by a DDC control board.

DX [and Hot Gas Reheat] Coils shall be provided with an on/off valve controlled by a DDC control board.

Electric Heaters shall be provided with a [Staged Relay or Silicon Controlled Relay] controlled by a DDC control board.

[Indirect or Direct] Gas Fired Furnaces shall be provided with a Modulating Valve and Ignition Relay Contact controlled by a DDC control board.

Humidifiers shall be controlled directly by a DDC control board.

Condensing Section

[Compressors or Water Source Heat Pumps] shall be provided with Relays for compressors and with all required Valves. Compressor staging, valves, and relays shall be controlled by a DDC control board.

Sensors

Filter pressure [switches or sensors] shall be provided at each filter bank. The DDC control board shall monitor the signals from each filter [switch/sensor] and indicate when filters need to be replaced.

A smoke detector shall be provided in the exhaust airstream. The DDC control board shall monitor the signal from this smoke detector and activate an alarm when smoke is detected.

Sensors shall be provided in each airstream to measure the airflow rate. The DDC control board shall monitor the signals from these sensors and output their status.

Controls by Others

Unit shall be provided with space for sensors, a control panel, and other control components and shall be shipped ready for configuration by a controls contractor.

Install Customer-Provided Controls

Manufacturer shall install a control system and control components as provided by [customer].