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Trane Building Management Systems

The Trane Company’s line of building management systems includes a product for every control need, from a remedy for a problem area in an existing building to a comprehensive system for a major complex or campus. Trane building management system capabilities and features include:

- Scheduling for weekdays and holidays
- After-hours usage tracking
- Management reports and logs
- Dynamic and interactive color graphics
- Direct digital control and custom programming routines
- Comfort monitoring by zone
- Energy-saving software including chiller plant control, demand limiting, optimal start/stop, and night setback
- Operator interface that is easy to learn and use
- Architecturally-compatible, ergonomic design

Trane is unique in its ability to offer total integrated comfort systems, HVAC, controls, and building management from a single source. These systems constitute a vigorous response to today’s demands from regulatory agencies, building designers, contractors, owners, and occupants.

Pages two through nine in this catalog illustrate four typical Trane building management system applications. They demonstrate the versatility and integration capabilities of the various products in this catalog. Each Trane building management installation is designed specifically for the facility it manages and may be configured differently than the examples shown.

### Standalone Building Control Systems

- Applied commercial
- Unitary

### Building Size

- Mid-size to large

### Features

- Time of day scheduling including optimum start/stop and night purge
- Demand limiting
- Timed override
- Reports and trends
- Remote communications
- Custom programming routines
- Chiller sequencing
- Year 2000 compliant
- Manufactured in an ISO 9001 certified facility

### Benefits

- Comprehensive set of reports to track and analyze data
- Reduced energy costs with standard, tested energy management applications
- Flexibility to provide after-hours comfort through timed override
- Quick identification of operating problems using equipment diagnostics
- Easy-to-use, dynamic color graphics (optional)

### Trane Sensors

Controlling the comfort in a building space begins with Trane sensors. We designed our sensors for use with Trane Tracer systems to provide the accuracy and repeatability required by DDC control. Trane sensors are compatible with a variety of Trane building level and unit level controllers. In addition, the sensors are architecturally compatible with each other and with modern building interiors.

#### Sensor Capabilities

Trane room temperature sensors are available in several variations, and include options for setpoint adjustment and override switches. Use Trane room humidity sensors to control humidifiers and dehumidification equipment.

Controlling building humidity is an important element in maintaining indoor air quality. Trane also offers field-applied sensors to measure pressure, temperature, and humidity in air and water applications.

#### CO2 Sensor Capabilities

Carbon dioxide is present in the air in variable amounts and can be measured in parts per million (PPM) by the Trane Carbon Dioxide (CO2) Sensor. Elevated concentrations of carbon dioxide in a building zone can indicate a space is occupied above design conditions, or that there is a problem or deficiency with the building’s ventilation system.

When connected to a Tracer building management system and the appropriate ventilation equipment, the Trane CO2 Sensor provides building designers, operators, and owners a practical and affordable means to respond to concerns of indoor air quality and occupant comfort.

Typical applications for the CO2 Sensor include:

- Monitoring and recording CO2 levels in occupied building spaces
- Identifying underventilated building zones
- Overriding outdoor air flow beyond design ventilation rates if CO2 exceeds an acceptable level
- Using CO2 measurement to identify changes in occupancy of a space

#### Hardware Description

The Trane CO2 Sensor can either be wall-mounted or duct-mounted using an optional duct enclosure kit.

For more information on the CO2 Sensor, refer to Trane publication BAS-PD-8.
IntelliPak Rooftop Units
The 20- to 130-ton IntelliPak Rooftop is a self-contained heating and cooling air handling unit. The IntelliPak can be configured as either constant volume or variable air volume system control. The IntelliPak UCM is factory-installed on each unit, and can be connected to a Tracer Summit BCU or a Tracer 100 series controller via a Trane Communication Interface (TCI). Each system provides control, monitoring, and diagnostics for the rooftop unit.

For more information about IntelliPak Rooftops, refer to Trane publication RT-DS-8.

Voyager Rooftop Units
The 3- to 50-ton Voyager Rooftop unit is a self-contained heating and cooling air conditioner normally installed on a building’s roof. We designed the Voyager Rooftop to compete in the price-competitive market of light commercial packaged rooftops. The Voyager can be factory-configured for either constant volume or variable air volume (27½- to 50-ton Voyager Commercial only) system control. The Voyager Micro is applied on all Trane Voyager Rooftops and can be connected to a Tracer Summit BCU, a Tracer 100 series controller or a Tracker panel via a TCI. Each system provides control, monitoring, and diagnostics for the rooftop unit.

For more information about air handler control systems, refer to Trane publications CLCH-S-24, CLCH-DS-7, CLCH-DS-9, and PCC-DS-1.

Terminal Unit Controllers
The Trane Terminal Unit Controller (TUC) is a microprocessor-based, direct digital controller used on the following terminal products:
- Fan coils
- Water source heat pumps
- Unit ventilators
- Blower coil air handling units

The TUC is configurable from a list of predefined features including 2-pipe or 4-pipe valve control, face and bypass damper control, compressor control, and economizer control. The TUC can be applied as a field-installed controller to retrofit existing air conditioning equipment. In addition, the TUC is available factory installed, wired and tested in Trane air conditioning equipment.

For more information about Terminal Unit Controllers, refer to page 26 of this catalog or Trane publication BAS-TS-7.

VariTrac Changeover-Bypass Zoning System
The VariTrac Central Control Panel (CCP) provides coordination, monitoring, and diagnostics for the VariTrac zone control system. The CCP also communicates with the VariTrac zone dampers to determine space heating and cooling requirements. The VariTrac Zoning System can communicate with Tracer Summit, the Tracer 100 series building controllers, and the Tracker building control panel.

For more information about VariTrac Central Control Panel, refer to Trane publications BAS-TS-73 and VAV-DS-12. Also, refer to page 20 in this catalog.

VAV Command Unit
The Tracer 100 series VAV Command Unit system provides control, monitoring, and diagnostics of Trane VAV terminal units. Through the VAV Command Units, the Tracer 100 series panel can maintain and monitor individual zone comfort requirements. The Tracer panel also makes the comfort system flexible to occupants’ cooling and heating requirements by grouping VAV terminal units together through software.

For more information about VAV Command Units, refer to Trane publication BAS-TS-64.

Air Handlers
Trane’s indoor, outdoor, and custom air handlers are available with complete turnkey factory-packaged controls systems. Universal PCMs, PCMs, sensors, actuators, and other control devices (including starters and variable frequency drives) are factory-engineered, mounted, wired, and tested.

For more information about Air Handlers, refer to Trane publication RT-DS-8.

Standalone Building Control

Building Management Systems
**Networked Building Control**

**Benefits**
- Reduced operating costs through energy management strategies
- Flexibility to grow with building expansion or remodeling
- Easy-to-learn, easy-to-use graphical user interface
- Consistent, reliable operation with standard, pre-engineered and pre-tested applications
- Faster, faster troubleshooting with in-depth data and diagnostic information
- Advance notice of system problems before they become an emergency
- Automatic printing or saving of reports for analysis or regulatory purposes
- Quick, at-a-glance graphical views of current building status
- Safety and peace of mind with multi-level operator security
- Truly open communications to BACnet-compatible subsystems or non-Trane equipment

**Features**
- Chiller plant control
- High speed ARCNET or Ethernet LAN communications between panels
- Graphical user interface
- Remote communications
- Custom programming routines
- Reports and trends
- Time of day scheduling including optimum start/stop and night economizing
- Area control to coordinate HVAC equipment and lighting
- VAV air system control
- Interoperability with other non-Trane systems and subsystems using the BACnet communications protocol
- Year 2000 compliant
- Manufactured in an ISO 9001 certified facility

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**Factory-Mounted Unit Control**

**Trane’s Integrated Comfort systems (ICS) concept incorporates the benefits of factory-mounted, wired, and tested microprocessor controls on each piece of Trane equipment described in this section.** Trane Tracer building management systems link the HVAC equipment into truly integrated comfort systems that address the critical issues facing building owners, engineers, and contractors.

**Chillers**

Trane chillers are available with a compressor type, refrigerant type, and capacity to meet nearly any need. These chillers are designed to provide a reliable source of chilled water and are equally suited for comfort, industrial, or process applications.

Unit controllers factory-mounted on Trane chillers provide access to information and functions within each chiller. This access allows the building management products described in this catalog to optimize the operation of each chiller individually and to optimize their performance within a chiller plant.

You can link any of the chillers listed below to a Trane ICS to provide system-level monitoring, diagnostics, and control capabilities, including sequencing chillers as well as controlling pumps and cooling towers:
- CenTraVac Centrifugal Chillers
- Series R CenTraVac Rotary Chillers
- Air-cooled and water-cooled Helical Rotary Chillers
- Air-cooled and water-cooled Scroll Chillers
- Absorption Chillers with UCP2, classic or Horizon controls
- Refrigerant management monitoring and reporting is also available for applicable chillers.

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**Commercial Self Contained Units**

Trane Commercial Self Contained air conditioners efficiently bridge the gap between unitary and central systems by factory-packaging rugged commercial components in a floor-by-floor decentralized system. Multiple, independent refrigerant circuits — using the 4-D scroll compressor — provide high performance redundancy. For application flexibility, units are factory-equipped for either water-cooled or remote air-cooled condensing.

Acoustically designed for location near occupied building spaces, one or more compact Commercial Self Contained air conditioners are commonly placed in an equipment room on each floor. Supply air is ducted to VariTrane VAV terminals. Alternatively, these units can be used with constant volume air supply systems.

Commercial Self Contained units equipped with UCPs can be connected directly to a Tracer Summit BCU or Tracer 100 series controller. These systems provide control, monitoring, and diagnostics capabilities.

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For more information about Commercial Self Contained Units, refer to Trane publications PROD-DG-1.

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**Building Management Systems**

For more information about VariTrane VAV terminals, refer to Trane publications VAV-D-7 and VAV-US-9.
DDC Chiller Sequencer

The DDC Chiller Sequencer is a sequencing panel that provides start/stop control of two chillers and associated pumps, setpoint control, lead/lag, soft loading, failure recovery, chilled water reset, and ice-making mode.

Software Capabilities

- **System enable**: A contact closure input to the panel selects either enable or disable mode. This input is typically connected to a time clock for time of day scheduling, but can be wired to a Manual/Off/Auto switch and thermostat to provide an ambient interface.

- **Chiller/pump control**: The DDC Chiller Sequencer provides binary outputs to control two chillers and two pumps.

- **Lead/lag control**: The operator can select manual or automatic chiller rotation through the panel keypad. Automatic rotation forces daily rotation at midnight. In the manual rotation mode, a separate manual 2-position switch is used to determine the lead chiller.

- **Soft loading**: Prevents unnecessary operation of the lag chiller on initial system startup.

- **Failure recovery**: In the event of a chiller failure, the lag chiller starts (through a normal Add program) when the system supply water temperature exceeds setpoint. The sequencer turns on its alarm output if:
  - the DDC Chiller Sequencer loses power
  - or the DDC Chiller Sequencer has a power failure
  - the individual chiller setpoint is automatically adjusted to maintain the common leaving water temperature at setpoint in 1-pump systems with one chiller enabled (constant flow through both chillers).

- **Chilled water reset**: Resets the system setpoint based on either return water temperature or a separate reset sensor input as determined in system setup.

Hardware Description

The DDC Chiller Sequencer package consists of a Trane 20-point PCM with LCD and keypad, a matched pair of thermistor sensors, and the sequencer software. For more information about the DDC Chiller Sequencer, refer to Trane publication BAS-MG-21.
Chiller Plant (Subsystem) Management

- Multiple chiller applications
- Ice storage systems
- Dual fuel chiller plants
- Comfort and industrial applications

Features
- Chiller sequencing
- Rotation changes
- Base, peak, and swing operation
- Soft start
- Individual chiller setpoint calculations
- Failure detection and recovery
- Manual override
- Chiller performance reports
- Remote communications
- Pump and tower control
- Interoperability with BACnet-compatible building management systems
- Refrigerant management monitoring and reports
- Year 2000 compliant
- Manufactured in an ISO 9001 certified facility

Benefits
- Improves chiller efficiency
- Reduces operating costs
- Balances equipment runtimes
- Provides data for management reports and maintenance
- Uses standard, tested control routines for reliable operation
- Recovers safely from power or machine failures
- Allows orderly startup and shutdown of chillers
- Protects the significant investment in the chiller plant

Lighting Control Panel
The Tracer Lighting Control Panel (LCP) is a microprocessor-based controller that manages building lighting circuits according to time of day schedules and local switch inputs.

The LCP can operate as a standalone device or interface to a Trane Tracer 100 or Tracer Summit building management system, integrating the HVAC and lighting systems. LCP accessories provide additional system flexibility and expansion capabilities.

An LCP telephone interface may complement the system by providing easy override access to any building occupant with a touch-tone telephone.

ICS Capability
A building operator can use a Tracer Summit BCU or a Tracer 100 series building management panel to monitor the status of switched inputs and lighting circuit outputs, provide time of day control, and integrate lighting control functions into the total building management system.

Software Capabilities
The LCP database groups relay outputs into independent lighting zones, and executes application programs such as blink warning and after-hours operator override.

Zones may be controlled by the following:
- Wall switches
- Occupancy sensors
- Commanded from Tracer applications programs
- Overridden via local keypad or remote touch-tone telephone

A standalone scheduling application allows the LCP to provide time of day control even when it is not linked with a Tracer building management system.

Blink Warning
LCP outputs can be programmed to provide blink warning before they are switched off at the end of a time of day schedule or override period. This allows occupants to safely exit the area or request additional override lighting via a wall switch input or touch-tone telephone.

Time of Day Scheduling
When used independently from a Tracer building management system, the LCP can be programmed to support weekday, weekend, and holiday time of day scheduling.

For more information about the LCP, refer to Trane publication BAS-PD-4.
Application-Specific Unit Control

Application-specific controllers are designed to provide custom control interfaces to specific types of equipment and applications. This contrasts with the general-purpose unit controllers, which provide flexible control options for a variety of equipment.

Terminal Unit Controller

The Terminal Unit Controller (TUC) is a microprocessor-based direct digital controller that can control a range of air conditioning equipment including:
- Fan coils
- Unit ventilators
- Water source heat pumps
- Blower coil air handling units

ICS Capabilities

When linked to a Trane Tracer system, the TUC provides building operators with centralized building management. Using a data communications link, you can connect TUCs to Tracer Summit, Tracer 100i, or Tracer L panels. These panels monitor the operation of TUC equipment and other unit controllers that are part of a Trane building management system. Tracer systems provide centralized control of equipment, including coordination of setpoints and schedules.

Software Capabilities

TUCs are proportional integral derivative (PID) control algorithms specifically developed for the equipment types listed above, to provide accurate and reliable control operation.

The TUC is configurable to provide several different predefined control schemes, including 2-pipe or 4-pipe valve control, face and bypass damper control, compressor control, and economizer control. The TUC is configurable for different input and output devices, such as 2-position, floating, or modulating valves.

The TUC can be applied as a field-installed controller to retrofit existing air conditioning equipment, including installation in non-Trane equipment. The TUC is also available factory-installed, wired, and tested in Trane air conditioning equipment.

Hardware Description

Two versions of the TUC are available for field installation:
- Standard ambient: NEMA Type 1 resin enclosure (32 to 120°F, 0 to 49°C)
- Extended ambient: NEMA Type 1 painted metal enclosure (-40 to 158°F, -40 to 70°C)

For more information about the TUC, refer to Trane publication BAS-PD-7.

Chiller Plant (Subsystem) Management
Simple Building Control

Systems
- Light commercial unitary systems

Building Size
- Small to mid-size

Features
- Time of day scheduling calculations
- Optimal start
- Trend logs
- Demand limiting
- Timed override
- Remote communications
- Fahrenheit or Celsius alternate language display
- French or Spanish alternate language display
- Multiple language support
- Allows the flexibility to temporarily turn on equipment after hours
- Reduces peak power demand without jeopardizing occupant comfort
- Can operate from the local keypad or from a personal computer
- Provides monitoring and control of analog output devices
- Integral, and derivative (PID) control of analog output devices
- PID gains are operator-defined as constants or as variables calculated in the PCL routines. The operator can graphically plot each DDC loop operation via the UPCM Edit software, to assist in optimizing the performance of controlled devices. UPCM Edit software also offers the following capabilities:
  - **Current point status** screens provide the status of each available hardware and software point. Diagnostic information about each hardware point is also available.
  - **Optional manual overrides** on each output card are available. The manual override on a binary output card is an On/Off/Auto switch. The manual override on an analog output card is a potentiometer.
  - The optional LCD provides monitoring capability and the ability to override points connected to a Universal PCM. This backlit, 2-line by 40-character display provides an operator interface via eight function keys, and includes four operator-definable status displays capable of displaying 16 points each. A fifth display includes Universal PCM status and diagnostics.
  - A calendar/time clock is included with the Universal PCM. This clock allows the Universal PCM to completely recover from a power failure with the correct time and data. The clock/calender is backed by a super capacitor for seven days under normal operating conditions.

Software Capabilities

Like the PCM, the Universal PCM has the flexibility of customized control sequences using UPCM Edit Software. Each Universal PCM supports 25 PCL routines and 20 DDC loops, which can execute at a maximum frequency of one second.

Operator-defined PCL routines can perform logical and mathematical calculations, and can be automatically executed or initiated by an event such as a binary input change-of-state or an analog input high or low limit. Each PCL routine can be manually executed, one statement at a time, in a special test mode to allow the operator to verify program logic.

DDC loops provide proportional, integral, and derivative (PID) control of analog output devices. PID gains are operator-defined as constants or as variables calculated in the PCL routines. The operator

Hardware Description

Three versions of the Universal PCM are available:
- **Standard ambient:** NEMA Type 1 metal enclosure consisting of a steel backplane and a resin cover (-40 to 70°C, 0 to 50°C)
- **Extended ambient:** NEMA Type 1 metal enclosure consisting of a steel backplane and a resin cover (-40 to 158°F , -40 to 70°C)
- **Weatherproof:** NEMA Type 4 metal enclosure suitable for outdoor use (-40 to 158°F , -40 to 70°C)

In addition to the enclosures listed above, a unit frame mount is also available. The Universal PCM is UL-approved as a modular energy management panel, allowing field assembly of the modular parts while maintaining UL approval.

The Universal PCM supports up to six operator-selectable, input/output cards (each with 6 points) for a total of 36 points.

For more information about the Universal PCM, refer to Trane publication BAS-705.
Programmable Control Module
A Programmable Control Module (PCM) provides direct digital control and monitoring for a wide range of HVAC and other applications. Typical uses include controlling air handling equipment, interfacing with water chilling units and boiler systems, and controlling pumps and cooling towers.

ICS Capability
The PCM extends the Trane ICS technology to existing, auxiliary, and non-Trane equipment. A PCM communicates with a Tracer building control system over a single communication link.

Software Capabilities
The PCM has the flexibility to provide custom standalone control sequences using Process Control Language (PCL). The PCL routines are programmable and can perform logical and mathematical calculations.

Both the PCL and DDC software provide special testing capabilities for the custom control sequences. Each PCL routine can be manually executed, one statement at a time, in a special test mode to allow the operator to verify the program logic. The performance of each DDC loop can be graphically plotted to assist the operator in tuning the loop.

PCM programs are written and compiled on a PC using PCM Edit software. This software also allows the operator to access the PCM to perform the following functions:
- Modify parameters
- Edit the display setup
- View input/output status
- Use the PCL test function
- Plot DDC loops
- Manually control the PCM outputs

Hardware Description
Three versions of the PCM are available:
- Standard ambient: NEMA Type 1 metal enclosure (32 to 120°F / 0 to 49°C)
- Extended ambient: NEMA Type 1 metal enclosure (-40 to 158°F / -40 to 70°C)
- Weatherproof: NEMA Type 4 metal enclosure suitable for outdoor use (-40 to 158°F / -40 to 70°C)

An optional display and keypad include a 2-line by 20-character LCD that can display up to 32 status and control points.

For more information about the PCM, refer to Trane publication BAS-TS-43.

Universal Programmable Control Module
The Universal Programmable Control Module, or Universal PCM, is a programmable, direct digital controller that provides control and monitoring for a wide range of equipment. Typical uses include controlling air handling units, monitoring chiller plants including pumps and cooling towers, and serving as a central point gathering panel.

ICS Capability
As part of the ICS family and as an extension of the existing PCM, the Universal PCM provides flexible, independent control for a variety of applications. Because of its flexibility, the Universal PCM can provide control of both Trane and non-Trane products. The Universal PCM communicates with the Tracer Building Management Systems.
General-Purpose Unit Control

General-purpose controllers provide the capability to tie Trane equipment without unit control modules and non-Trane equipment into the Trane communication network. Products include the Thermostat Control Module, Programmable Control Module, and the Universal Programmable Control Module.

Thermostat Control Module

The Thermostat Control Module (TCM) provides a basic yet powerful interface between Tracer Summit, Tracer 100 series, or Tracker systems and mechanical equipment.

The TCM can extend the Integrated Comfort system (ICS) technology to existing, auxiliary, and non-Trane equipment. The TCM communicates with a building controller over a single communication link.

ICS Capability

The TCM provides an interface between the building control panel and equipment not having Trane Unit Control Modules (UCMs), such as lighting, fans, and non-Trane unitary equipment normally operated by a standard thermostat.

In thermostat mode, the TCM monitors its sensors and controls its outputs like a wall thermostat. The TCM can be configured as either a 2-stage heat/2-stage cool air conditioning thermostat or a heat pump thermostat. This control resides in the TCM, and the TCM can operate standalone (without the building management panel) during system startup or when there is a communication loss.

In slave mode, the building controller monitors the TCM inputs and directly controls the TCM outputs. The TCM input and output points function as though they are hardwired, generic points on the building control panel.

Software Capabilities

The TCM can function either as a 2-stage heat/2-stage cool thermostat for air conditioning units and heat pumps, or as a provider of slave points for the building management panel.

See the appropriate Building Control section of this catalog for details on each panel’s capabilities.

Hardware Description

Three versions of the TCM are available:

- Standard ambient: Resin enclosure (32 to 120°F, 0 to 49°C)
- Extended ambient: NEMA Type 1 metal enclosure (-40 to 158°F, -40 to 70°C)
- Weatherproof: NEMA Type 4 metal enclosure suitable for outdoor use (-40 to 158°F, -40 to 70°C)

For more information about the TCM, refer to Trane publication BAS-TS-32.
The system can provide multiple On/Off time periods per day for each of the seven weekdays. It can also provide:

- Holiday schedules and multiple holiday dates
- Exception day schedules
- Automatic daylight saving time
- Optimal start by group

**Setpoint Control**
The system allows the operator to control setpoints for all VariTrac zone UCMs. Setpoint control includes occupied and unoccupied heating and cooling setpoints, and air volume minimum and maximum setpoints. If desired, use a setpoint control mounted on the zone sensor. The setpoint knob can be enabled and disabled via the Tracer Summit, Tracer 100, or Tracker system. The operating range of the setpoint knob can be limited to maintain system stability while still allowing for occupant comfort control.

**4 Hours Override**
Use either a space-mounted override button, or the Tracker, Tracer Summit, or Tracer 100 system to temporarily provide override from the unoccupied to the occupied mode. The system can also specify the length of the override period. An override for a specific zone becomes an override for its group. The associated HVAC unit operates in the occupied mode for the duration of the override period.

**Group Control**
The Tracker, Tracer Summit, or Tracer 100 system enables access to overrides by group. This allows the operator to manually control the groups’ occupied/unoccupied mode, damper position override, and VAV terminal unit heater and fan mode if available. It also provides for operation of a ventilation cycle when the HVAC unit is in a zero energy state. This provides greater zone ventilation capability without affecting comfort.

**System Status**
The current operating status of the VariTrac system can be accessed through the Tracker or Tracer Summit, or Tracer 100 system. The operator can view a service summary of the entire VariTrac system at a glance, a more detailed view of each zone, or the current operating status of the HVAC unit.

**Alarming and Alarm Log**
The Tracker, Tracer Summit, or Tracer 100 system has the capability of monitoring VariTrac for system and zone alarms. Such things as sensor failure or communication loss can be monitored. Custom alarms are also available. The system retains a list of past alarms in an alarm log for operator review. If a Trane Voyager rooftop is attached to the VariTrac system, Voyager alarms can be monitored.

For more information about the VariTrac II CCP, refer to Trane publication BAS-TS-73.
ICS Architecture

Trane is uniquely qualified to implement system-wide strategies for energy efficiency, refrigerant management, and indoor air quality based on expertise gained from thousands of building automation installations and more than 80 years as an HVAC systems provider.

Trane’s Integrated Comfort system (ICS) architecture integrates operator workstations, building management panels, and HVAC equipment with microprocessor-based control modules for total building operating efficiency and comfort. The ICS architecture also interfaces with other building systems, such as fire alarm and lighting control.

The foldout on the previous page illustrates the three levels of an ICS architecture:
• Operator interface
• Building control
• Unit control

Operator Interface
PC-based operator workstations provide an advanced graphical interface that enables operators to perform building operation functions quickly with minimal experience and training. These tasks include:
• Viewing the status of the building
• Changing setpoints
• Viewing and modifying schedules
• Responding to alarms
• Viewing historical report information

Unit Control
Trane microprocessor-based unit control modules provide pressure, temperature, and flow control of HVAC equipment, in addition to making comprehensive diagnostic information available to building management system operators. These Unit Control Modules (UCMs) are factory-mounted on a broad range of Trane equipment.

Building Control
Building control functions including energy management, equipment coordination, and alarm processing are performed by Tracer Summit, Tracer 100 series, or Tracker building management panels. These panels may be located in a single facility or in remote buildings with dial-up access for communication.

With thousands of building management panels in operation, the full line of Trane building management systems is proven technology.

Remote Operations
The Tracker system has advanced communication and operation capability via a directly connected edit device, or remotely via an optional internal modem. The Tracker features a standard RS-232 port for connecting the edit terminal. All status and setup features previously discussed are accessible through the RS-232 port or modem, along with these additional capabilities:
• Trend logs (up to 8) are available to monitor any analog input in the system.
• Custom alarms (up to 24) can be configured in addition to the standard alarm list. These alarms can be configured for automatic dial out via modem for remote alarm notification.
• Demand limiting. The Stat 16 model is capable of demand monitoring and limiting up to 24 loads. All HVAC loads utilize temperature-compensated demand control to ensure occupant comfort. Twenty-four hour and 5-day energy history usage logs are available to provide the operator with historical data on kW peaks and kWh consumption.

For more information about Tracker, refer to Trane publications BAS-TS-47 and BAS-S-18.

Simple Zoning Control
The VariTrac II comfort control system provides individual temperature control to each comfort zone in a building while using the same single zone air conditioning unit. The VariTrac II also varies the flow of supply air to each zone, providing the heating and cooling capacity required to match the load in each specific zone.

ICS Capability
The VariTrac II Central Control Panel (CCP) interfaces with the Tracker, Tracer Summit, or Tracer 100 series building management system. It provides control, monitoring, and diagnostics of the individual VariTrac dampers. CCP and corresponding HVAC unit.

Software Capabilities
The VariTrac II CCP scans the zone UCMs to determine the deviations from setpoint, length of deviation, time from last heat or cool changeover, and number of zones requiring heating or cooling. Based on this information, the CCP selects the system heat or cool mode and stages of capacity. The CCP also monitors the system air temperature to ensure that high and low temperature limits are maintained.

The CCP monitors system air velocity or static pressure and VariTrac damper position to control duct air pressure, and to maintain proper air velocity through the HVAC unit.

Group Control of Zones
All VariTrac UCM zone dampers on a system can be designated as a member of one or four groups. All group members respond together to group commands such as timed override, time of day control, air flow control override, and ventilation settings.

Tracker, Tracer Summit, and Tracer 100 Series Operating Capabilities
Occupied/Unoccupied Mode
The Tracker, Tracer Summit, or Tracer 100 series panel provides time of day control for the VariTrac II zone groups. Each group on a VariTrac system can be individually scheduled, enabling greater scheduling flexibility of each HVAC system. When any group is in the occupied mode, the associated HVAC unit operates in the occupied mode.
Operator Interface

Tracer Summit and Building Management Network are the options available for high-level operator interface.

Operator interfaces provide global control and serve as a communication link between the operator and the building management panels. These operator interfaces use a distributed processing architecture, which shares information with building control panels and unit controllers — the other two levels of a building automation system.

Tracer Summit PC Workstation

The PC Workstation is the primary operator interface for the Tracer Summit system. Each PC Workstation provides a graphical interface to system information. The operator can create and edit system databases, view current and trended information, acknowledge alarms, and perform operator overrides and other operator transactions from the PC Workstation. Extensive usability testing incorporated into the design of the product makes the Tracer Summit PC Workstation software easy to use.

ICS Capability

The PC Workstation and the Tracer Summit software serve as a communication link between the operator and the Building Control Units (BCUs)’s and other equipment. PC Workstations can be connected and disconnected on an ARClNET or Ethernet local area network (LAN) as needed. System operation is not dependent on the PC Workstation. The Tracer Summit system uses an object-oriented database that resides in the BCUs. Each PC workstation contains a backup copy of the fully distributed database. The system is scanned at regular intervals to update the database with changes made from any PC Workstation.

Operators have the ability to view the current setup and configuration for all unit controllers, inputs, and outputs for a selected site. This information can be accessed by a PC Workstation onsite or remotely via a modem connection. Operators with the proper security access can edit, add, or delete objects. Each editor uses a graphic interface that allows quick and easy revision of setup and configuration values.

BACnet Standard Protocol Compatibility

Tracer Summit system communication is based on ASHRAE/ANSI BACnet Standard 155-1995 which standardizes communications between the PC Workstation, BCU, and other BACnet-compatible devices. This enables interoperability with non-Trane building management systems and subsystems.
Building Management Systems

Application Programs

Tracer Summit offers the following capabilities:

- **Time of day scheduling** controls schedules for equipment for each weekday, as well as for holidays and exception days. Using time of day schedules, the operator can define equipment start and stop times, optimal start and optimal stop times, and night economize times. Each daily schedule can contain multiple actions. Time of day schedules are easily copied from one day to another, or from one area to another.

- **Area control** allows the operator to coordinate HVAC equipment and lighting in specific areas of a building with the time of day scheduling application. Unit controllers and binary outputs can be assigned as members of an area; the area is then controlled instead of each member individually — making setpoint changes, scheduling, and operator overrides easy and efficient.

- **VAV air system control** coordinates air handling units and VAV Terminal Units within a building. VAV Terminal Units are assigned to the air handling unit that supplies air to the terminal unit, then VAV air system control coordinates system startup and shutdown to assure proper static pressure control.

- **Custom programming language (CPL)** allows the BCU to be customized for the application(s) it provides. CPL routines can be created to accommodate any non-standard control strategies and are used to sequence equipment, calculate setpoints and values, and perform shutdown sequences. CPL routines can be edited, downloaded, uploaded, and tested while the PC Workstation is online or offline with the BCUs.

- **Reports and trends** allows the operator to view system data in two primary reports: a live or log report, or a historical trend or report. Live reports provide a record of system conditions at one point in time and are used to look at ICS equipment status, system logs, and to view monthly conditions. Historical reports are used to look at numerous data samples over a fixed time interval. Trends, monthly energy reports, refrigerant management reports, and indoor air quality reports are examples of historical reports. All reports can be viewed on screen, printed as shown on screen, or exported to a spreadsheet program to create charts and graphs.

- **Diagnostics** ensure that devices such as modems, printers, and communication links are operating properly.

- **Programming interfaces** with PCM and UPCM Edit software. This software allows the operator to edit the DDC loops and program logic in these programmable controllers.

- **Remote communications** allows a PC Workstation to access a Tracer Summit site remotely through a single system through a unit-to-unit communication link. Multiple Tracers can be integrated into a single system through a unit-to-unit communication link.

- **Process control language (PCL)** allows the operator to define custom control sequences, which complement standard control programs by addressing a building’s individual requirements. PCL routines perform calculations based on real time data, and can use analog and binary point values, alarm status, constants, equation variables, and mathematical and logical operations.

- **Timed override** allows the operator to temporarily turn on a device or a specified equipment group that was scheduled off. Timed override can be activated by a switch on a zone sensor or by a keyboard command from a CRT. Weekly and monthly timed override reports document after-hours operation.

**ICS Status Displays**

All Trane ICS equipment has standard, preformatted displays that provide current, historical, and diagnostic data.

**Tracer L and 100i Hardware**

Tracer L, 1000, and CPM contain a single circuit card that incorporates processor, memory, and communications functions. Each unit includes battery backup, RS-232 communications ports, and an optional internal modem.

ICS system hardware includes the Tracer panel, optional system CRT, and optional printer. Multiple Tracers can be integrated into a single system through a unit-to-unit communication link.

Tracers can be operated through the standard CRT, or optionally, through PC-based Tracer Building Management Network operator workstations. Building Management Network provides a dynamic operator interface through the use of color graphics.

Refer to the Operator Interface section of this catalog for more information about Building Management Network.

For more information refer to Trane publication BAS-S-10.
Enclosure Specifications

The BCU panel has a NEMA Type 1 rated enclosure designed for indoor installation only. The BCU is designed to operate between 32°F to 120°F (0°C to 49°C) at relative humidities between 10% to 90%, non-condensing.

For more information about the Tracer Summit BCU, refer to Trane publication BAS-PD-3.

Tracer 100 Series Systems: Tracer L, CPM, and 100i

The Tracer 100 series panels are capable of monitoring HVAC equipment, providing the operator with management information, and communicating with other Tracer system equipment. They also provide building automation and energy management functions through standalone control of HVAC equipment.

ICS Capability

Tracer L, 100i, and Chiller Plant Manager (CPM) communicate over a twisted wire pair with UCMs on Trane HVAC equipment or Trane general-purpose controllers on non-Trane or existing equipment. The ICS approach provides extensive monitoring and control capabilities while simplifying and reducing the cost of installation.

Software Capabilities

Tracer L, 100i, and CPM provide the following features and capabilities to monitor equipment:

- **Zone control** groups associated HVAC equipment into zones to coordinate their operation. Zone parameters include occupied/unoccupied heating and cooling setpoints and temperature offsets for demand limiting and duty cycle modes.
- **Run time and maintenance** software monitors equipment run time, equipment starts, and calendar dates to generate maintenance messages.
- **Custom messages** can be created and used with run time and maintenance software and alarm processing functions.
- **Trend log** retains a historical record of values for specified points.
- **Totalizing** software automatically monitors any operator-defined flow such as airflow or calculated values such as BTU consumption, and generates a standard monthly report.
- **Boolean processing** software enables the operator to devise customized control functions using true/false logic statements.
- **Time of day scheduling** allows the operator to define equipment schedules for each weekday, plus holiday and exception schedules. Time of day scheduling provides both time of day start/stop and optimal start/stop control.

Reports and logs provide the operator with access to important system data. The following types of reports are available:
- Current, daily, and monthly energy use
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For more information about the Tracer Summit BCU, refer to Trane publication BAS-PD-3.
Building Control

Tracer Summit Building Control Units (BCU-s). Tracer 100 series building management panels, and Tracker all monitor and coordinate control of Trane HVAC equipment, non-Trane HVAC equipment, and related building systems.

Software Capabilities

Application Programs

The BCU enables the following building management functions:

- Time of day scheduling
- Area control
- VAV air system control
- Custom programming language
- Reports and trends
- Security
- Chiller plant control

BACnet Standard Protocol Compatibility

Tracer Summit system communication is based on ASHRAE/ANSI BACnet Standard 135-1995, which allows open communications between the PC, Workstation, BCU, and other BACnet-compatible devices. In an open environment, the BCU serves as a gateway to Trane UCMs, sharing data on operating conditions and alarms with other vendors’ systems.

Alarm Processing

Tracer Summit software receives alarms from the BCU’s. Alarms are prioritized into 20 operator-definable levels, and can be routed to any workstation and printer in the system either on or offsite.

Hardware Description

Communication Links

The BCU has three slots for UCM communication links. These links allow the BCU to communicate with the following UCMs:

- GenTrVac chillers with UCP1 or UCP2 controls
- Series 8 GenTrVac chillers with UCP1 or UCP2 controls
- Scroll chillers with IntelliPak, classic or Scroll Manager Module (SMM) controls

Absorption chillers with UCP2, classic or Horizon controls

Other Trane controls

- Programmable control module (PCM)
- Universal programmable control module (UPCM)
- Thermostat Control Module (TCM)
- Lighting Control Panel (LCP)
- Tracer 1000 building management interface option

Option Card Slots

Three card slots in the BCU provide the flexibility to configure an RS-252 communication card or modem, an ARCNET or Ethernet node interface card, or an ARCNET hub card.

Modular Installation

The BCU can be installed in a series of steps to increase efficiency and ease of installation, and to protect the hardware:

1. Installation
2. Software configuration
3. Hardware setup
4. System testing
5. User training
Building Control

Tracer Summit Building Control

The BCU is an intelligent field panel that communicates with multiple Trane Unit Control Modules (UCMs).

ICS Capability

• Time of day scheduling
• Area control
• VAV air system control
• Custom programming language
• Reports and trends
• Security
• Chiller plant control

Software Capabilities

Application Programs

The BCU enables the following building management functions:

• Absorption chillers with UCP2, classic or Horizon controls
• Series R air and water-cooled helirotor chillers

Trane unitary controls

• Voyager rooftop air conditioner units
• IntelliPak rooftop air conditioner units

Commercial self-contained units

• Water source heat pumps with the Trane terminal unit controls

Other Trane controls

• Programmable control module (PCM)
• Universal programmable control module (UPCM)
• Thermostat Control Module (TCM)
• Lighting Control Panel (LCP)
• Tracer 1000 building management interface option

Hardware Description

Software Capabilities

Building Management Network

Building Management Systems

ICS Capability

• Building Management Network (BMN) is a software package used to communicate with Tracer and Tracker panels. These panels may be located in the same facility or in different remote facilities.

BMN’s communication capabilities make detailed ICS information available. With BMN’s dynamic interface, an operator can monitor and control up to 120 independent Tracer and Tracker systems.

BMN receives specific mechanical equipment alarm data as it occurs from remote unit controllers via modem or from equipment in the same building. BMN provides detailed diagnostic information unique to the equipment involved, including probable servicing solutions. BMN can also dial out to remote ICS locations automatically each day to collect specific point data and usage reports. Any modification to schedules or setpoints for a group of buildings can be easily implemented across all Tracer systems.

Software Capabilities

BMN offers the following software capabilities:

• An event log retains a historical record of events, including alarms.
• Reports provide the operator with access to important energy and billing data. The following types of reports are available:
  - Daily and monthly energy usage reports
  - HVAC unit controller and zone status reports
  - Weekly and monthly after hours usage reports
• A trend log retains a historical record of values for specified points. This information often provides troubleshooting answers for service technicians.
• Operator-defined maintenance messages can be used with alarms or equipment run time limits to help schedule preventive maintenance.
• Save and restore software saves programming from a Tracer or Tracker panel to a disk. A remote panel can be reprogrammed later by downloading the saved programming.
• Optional color graphics display point information from Tracer panels on customized dynamic color graphics. The color graphics software operates using a mouse and function keys with pop-up menus. Color graphics is not available with Tracker panels. Background graphics can be created using a generic graphics package, or they can be used from the supplied graphics library. This library includes graphics of HVAC equipment such as fans, pumps, valves, chillers, and VAV terminal units.
• An optional scheduling feature allows an operator to schedule up to 120 Tracer 100 series panels using the power of the PC. This simplifies schedule setup and allows for advance scheduling of zones. This option also allows for easy shutdown of multiple buildings in an emergency.

Refer to the Tracer 100 Series Systems and Tracker and VariTrac Zoning System sections of this catalog for more information about the capabilities available through BMN.

Hardware Description

BMN runs on a PC with an 80386 or higher processor. A modem is required at the PC for remote communications via a telephone line. A direct-connect cable is used if the PC is directly wired to a Tracer or Tracker panel.

BMN can establish remote communications (via modem) with up to 120 different building management panels.

For more information about BMN, refer to Trane publication BAS-TS-57.

ECS Help 10:59 Connected: Hilton

16 Building Management Systems
Enclosure Specifications
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For more information about the Tracer Summit BCU, refer to Trane publication BAS-PD-3.

Tracer 100 Series Systems: Tracer L, CPM, and 100i
The Tracer 100 series panels are capable of monitoring HVAC equipment, providing the operator with management information, and communicating with other Tracer series systems. They also provide building automation and energy management functions through standalone control of HVAC equipment.

ICS Capability
Tracer L 100i, and Chiller Plant Manager (CPM) communicate over a twisted wire pair with UCNs on Trane HVAC equipment or Trane general-purpose controllers on non-Trane or existing equipment. The ICS approach provides extensive monitoring and control capabilities while simplifying and reducing the cost of installation.

Software Capabilities
Tracer L 100i, and CPM provide the following features and capabilities to monitor equipment:

- **Zone control** groups associated HVAC equipment into zones to coordinate their operation. Zone parameters include occupied/unoccupied heating and cooling setpoints and temperature offsets for demand limiting and duty cycle modes.
- **Run time and maintenance** software monitors equipment run time, equipment starts, and calendar dates to generate maintenance messages.
- **Custom messages** can be created and used with run time and maintenance software and alarm processing functions.
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  - Current, daily, and monthly energy use
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optional hardware:
- Additional memory and disk capacity
- Network card for ARCNET® or Ethernet
- Serial port or internal modem (Recommended modem: 3Com/ U.S. Robotics Sportster)
- Parallel printer
- Tracer Summit PC Workstation package includes:
  - Workstation software on CD
  - Library of graphic images and routines
  - Microsoft Internet Explorer 4.0
  - Documentation for the installer, daily user, and programmer
  - Mouse pad

PC Workstation Specifications
Tracer Summit PC Workstation minimum requirements are:

- Pentium Processor
- 32 Mb of RAM (64 Mb for use on Windows NT)
- 1.5 Gb hard disk
- 4X CD ROM drive
- 1.44 Mb 3.5 inch floppy drive
- 800 x 600 x 16 bit color video support
- Mouse, Keyboard
- Windows® 95, 98 or NT 4.0
- Operating System
- Parallel port for printer

any number of remote locations based on alarm conditions, time, date, or other operator-specified criteria. If the remote PC, Workstation or pager is unavailable, the system will re-try, or at the operator's preference, try a different PC, Workstation or pager.

A single modem located in any BCU on the system provides remote access to the entire system. Modems may be installed in multiple BCUs for additional access ports, if desired.

- **Security**. A sophisticated password system protects the Tracer Summit system.
- **Chiller plant control** allows the operator to coordinate multiple chillers and their related equipment (pumps, valves, cooling towers, ice tanks, etc.) to supply cold water to the system.

Multiple chillers can be sequenced to balance run times between chillers and to improve overall system operating efficiency. This application also enhances chiller alarm processing and failure recovery, provides status and feedback information, optimizes energy usage, and helps in chiller maintenance and repair.

For more information about the Tracer Summit PC Workstation, refer to Trane publication BAS-PD-2.
**Building Management Systems**

**Application Programs**

Tracer Summit offers the following capabilities:

- **Time of day scheduling** controls schedules for equipment for each weekday, as well as for holidays and exception days. Using time of day schedules, the operator can define equipment start and stop times, optimal start and optimal stop times, and night economize times. Each daily schedule can contain multiple actions. Time of day schedules are easily copied from one day to another, or from one area to another.

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- **Diagnostics** ensure that devices such as modems, printers, and communication links are operating properly.

- **Programming interfaces** with PCM and UPCM Edit software. This software allows the operator to edit the DDC loops and program logic in these programmable controllers.

- **Remote communications** allows a PC Workstation to access a Tracer Summit site remotely using standard telephone modems. This enables an operator to change setpoints from home, or for service technicians to change configuration from their office as if they were at the site.

  The remote communication function also provides the ability to dial out alarms. The Tracer Summit system can be configured to dial out alarms to:

  - **Demand limiting** monitors the building's electrical demand and turns off certain electrical loads or resets equipment setpoints when demand exceeds a specified limit. This helps to reduce peak power demand and subsequent utility costs. Each demand limited load has a maximum off time and temperature limits to ensure occupant comfort.

  - **Chiller sequencing** sequences and automatically rotates up to six chillers and their associated pumps to control and monitor chiller operation. The sequencing program can be used to control virtually any type of water chiller.

  - **Priority control** allows the operator to define custom control sequences that respond to alarm conditions. Priority control sequences receive the highest priority, overriding all other control sequences.

  - **Process control language (PCL)** allows the operator to create custom control sequences, which complement standard control programs by addressing a building's individual requirements. PCL routines perform calculations based on real-time data, and can use analog and binary point values, alarm status, constants, equation variables, and mathematical and logical operations.

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The PC Workstation and the Tracer Summit software serve as a communication link between the operator and the Building Control Units (BCUs) and other equipment. PC Workstations can be connected and disconnected on an ARCNET or Ethernet local area network (LAN) as needed. System operation is not dependent on the PC Workstation.

The Tracer Summit system uses an object-oriented database that resides in the BCUs. Each PC Workstation contains a backup copy of the fully distributed database. The system is scanned at regular intervals to update the database with changes made from any PC Workstation.

Operators have the ability to view the current setup and configuration for all unit controllers, inputs, and outputs for a selected site. This information can be accessed by a PC Workstation onsite or remotely via a modem connection. Operators with the proper security access can edit, add, or delete objects. Each editor uses a graphic interface that allows quick and easy revision of setup and configuration values.

Software Capabilities

Graphical Operation

Graphics are the main method of viewing the system. Graphics show building status information at a glance and allow you to move through the system just like walking through the building. You can also use the graphics to change setpoints and override equipment operation. Using graphics in Tracer Summit is as simple as surfing the Web because Trane has incorporated Microsoft’s Internet Explorer into Tracer Summit to display graphics.

Tracer Summit software includes a library of standard graphics for all Trane equipment and applications that ship as part of the product. Custom graphics can be created using the graphics editor that is also part of the software.

BACnet Standard Protocol Compatibility

Tracer Summit system communication is based on ASHRAE/ANSI BACnet Standard 135-1995 which standardizes communications between the PC Workstation, BCU, and other BACnet-compatible devices. This enables interoperability with non-Trane building management systems and subsystems.
ICS Architecture

Trane is uniquely qualified to implement system-wide strategies for energy efficiency, refrigerant management, and indoor air quality based on expertise gained from thousands of building automation installations and more than 80 years as an HVAC systems provider.

Trane’s Integrated Comfort System (ICS) architecture integrates operator workstations, building management panels, and HVAC equipment with microprocessor-based control modules for total building operating efficiency and comfort. The ICS architecture also interfaces with other building systems, such as fire alarm and lighting control.

The foldout on the previous page illustrates the three levels of an ICS architecture:
- Operator interface
- Building control
- Unit control

Operator Interface
PC-based operator workstations provide an advanced graphical interface that enables operators to perform building operation functions quickly with minimal experience and training. These tasks include:
- Viewing the status of the building
- Changing setpoints
- Viewing and modifying schedules
- Responding to alarms
- Viewing historical report information

With thousands of building management panels in operation, the full line of Trane building management systems is proven technology.

Unit Control
Trane microprocessor-based unit control modules provide pressure, temperature, and flow control of HVAC equipment, in addition to making comprehensive diagnostic information available to building management system operators. These Unit Control Modules (UCMs) are factory-mounted on a broad range of Trane equipment.

Auxiliary equipment without factory-mounted UCMs, such as cooling towers, pumps, boilers, and non-Trane HVAC equipment, can be linked through Trane field-installed controllers. These standalone devices are the ideal base for the HVAC control system upgrades that are often part of major facility renovations.

Remote Operations
The Tracker system has advanced communication and operation capability via a directly connected edit device, or remotely via an optional internal modem. The Tracker features a standard RS-232 port for connecting the edit terminal. All status and setup features previously discussed are accessible through the RS-232 port or modem, along with several additional capabilities:
- Trend logs (up to 8) are available to monitor any analog input in the system.
- Custom alarms (up to 24) can be configured in addition to the standard alarm list. These alarms can be configured for automatic dial out via modem for remote alarm notification.
- Demand limiting. The Stat 16 model is capable of demand monitoring and limiting up to 24 loads. All HVAC loads utilize temperature-compensated demand control to reduce air conditioning capacity required to match the load in each specific zone.

ICS Capability
The VariTrac II Central Control Panel (CCP) interfaces with the Tracker, Tracker Summit, or Tracker 100 series building management system. It provides control, monitoring, and diagnostics of the individual VariTrac dampers. CCP and corresponding HVAC unit.

Software Capabilities
The VariTrac II CCP scans the zone UCMs to determine the deviations from setpoint, length of deviation, time from last heat or cool changeover, and number of zones requiring heating or cooling. Based on this information, the CCP selects the system heat or cool mode and stages of capacity. The CCP also monitors the system air temperature to ensure that high and low temperature limits are maintained.

The CCP monitors system air velocity or static pressure and VariTrac damper position to control duct air pressure, and to maintain proper air velocity through the HVAC unit.

Group Control of Zones
All VariTrac UCM zone dampers on a system can be designated as a member of one or four groups. All group members respond together to group commands such as timed override, time of day control, air flow control overrides, and ventilation settings.

Tracker, Tracker Summit, and Tracker 100 Series Operating Capabilities

Simple Zoning Control
The VariTrac II comfort control system provides individual temperature control to each comfort zone in a building while using the same single zone air conditioning unit. The VariTrac II also varies the flow of supply air to each zone, providing the heating and cooling capacity required to match the load in each specific zone.
The system can provide multiple On/Off time periods per day for each of the seven weekdays. It can also provide:

- Holiday schedules and multiple holiday dates
- Exception day schedules
- Automatic daylight saving time
- Optimal start by group

**Setpoint Control**
The system allows the operator to control setpoints for all VariTrac zone UCMs. Setpoint control includes occupied and unoccupied heating and cooling setpoints, and air volume minimum and maximum setpoints. If desired, use a setpoint control mounted on the zone sensor. The setpoint knob can be enabled and disabled via the Tracer Summit, Tracer 100, or Tracker system. The operating range of the setpoint knob can be limited to maintain system stability while still allowing for occupant comfort control.

**After Hours Override**
Use either a space-mounted override button, or the Tracker, Tracer Summit, or Tracer 100 system to temporarily provide override from the unoccupied to the occupied mode. The system can also specify the length of the override period. An override for a specific zone becomes an override for its group. The associated HVAC unit operates in the occupied mode for the duration of the override period.

**Group Control**
The Tracker, Tracer Summit, or Tracer 100 system enables access to overrides by group. This allows the operator to manually control the groups’ occupied/unoccupied mode, damper position override, and VAV terminal unit heater and fan mode if available. It also provides for operation of a ventilation cycle when the HVAC unit is in a zero energy state. This provides greater zone ventilation capability without affecting comfort.

**System Status**
The current operating status of the VariTrac system can be accessed through the Tracker or Tracer Summit, or Tracer 100 system. The operator can view a service summary of the entire VariTrac system at a glance, a more detailed view of each zone, or the current operating status of the HVAC unit.

**Alarming and Alarm Log**
The Tracker, Tracer Summit, or Tracer 100 system has the capability of monitoring VariTrac for system and zone alarms. Such things as sensor failure or communication loss can be monitored. Custom alarms are also available. The system retains a list of past alarms in an alarm log for operator review. If a Trane Voyager rooftop is attached to the VariTrac system, Voyager alarms can be monitored.

For more information about the VariTrac II CCP, refer to Trane publication BAS-TS-73.
General-Purpose Unit Control

General-purpose controllers provide the capability to tie Trane equipment without unit control modules and non-Trane equipment into the Trane communication network. Products include the Thermostat Control Module, Programmable Control Module, and the Universal Programmable Control Module.

Thermostat Control Module

The Thermostat Control Module (TCM) provides a basic yet powerful interface between Tracer Summit, Tracer 100 series, or Tracker systems and mechanical equipment.

The TCM can extend the Integrated Comfort system (ICS) technology to existing, auxiliary, and non-Trane equipment. The TCM communicates with a building controller over a single communication link.

**ICS Capability**

The TCM provides an interface between the building control panel and equipment not having Trane Unit Control Modules (UCMs), such as lighting, fans, and non-Trane unitary equipment normally operated by a standard thermostat.

**Software Capabilities**

The TCM can function either as a 2-stage heat/2-stage cool air conditioning thermostat or a heat pump thermostat. In thermostat mode, the TCM monitors its sensors and controls its outputs like a wall thermostat. The TCM can be configured as a heat pump thermostat. This control resides in the TCM, and the TCM can operate standalone (without the building management panel) during system startup or when there is a communication loss.

In slave mode, the building controller monitors the TCM inputs and directly controls the TCM outputs. The TCM input and output points function as though they are hardwired, generic points on the building control panel.

The building control panel provides control such as time of day scheduling and demand limiting.

**Hardware Description**

Three versions of the TCM are available:
- Standard ambient: Resin enclosure (32 to 120°F, 0 to 49°C)
- Extended ambient: NEMA Type 1 metal enclosure (-40 to 158°F, -40 to 70°C)
- Weatherproof: NEMA Type 4 metal enclosure suitable for outdoor use (-40 to 158°F, -40 to 70°C)

For more information about the TCM, refer to Trane publication BAS-TS-32.
Programmable Control Module

A Programmable Control Module (PCM) provides direct digital control and monitoring for a wide range of HVAC and other applications. Typical uses include controlling air handling equipment, interfacing with water chilling units and boiler systems, and controlling pumps and cooling towers.

ICS Capability

The PCM extends the Trane ICS technology to existing, auxiliary, and non-Trane equipment. A PCM communicates with a Tracer building control system over a single communication link.

Software Capabilities

The PCM has the flexibility to provide custom standalone control sequences using Process Control Language (PCL). The PCL routines are programmable and can perform logical and mathematical calculations.

The PCM also provides direct digital control (DDC) loops, which are separate software modules, enabling proportional, integral, and derivative (PID) control of modulating devices. The operator can define PID gains along with high and low output limits. The PCL routines and DDC loops can execute as frequently as once every five seconds.

Both the PCL and DDC software provide special testing capabilities for the custom control sequences. Each PCL routine can be manually executed, one statement at a time, in a special test mode to allow the operator to verify the program logic. The performance of each DDC loop can be graphically plotted to assist the operator in tuning the loop.

PCM programs are written and compiled on a PC using PCM Edit software. This software also allows the operator to access the PCM to perform the following functions:

- Modify parameters
- Edit the display setup
- View input/output status
- Use the PCL test function
- Plot DDC loops
- Manually control the PCM outputs

Universal Programmable Control Module

The Universal Programmable Control Module, or Universal PCM, is a programmable, direct digital controller that provides control and monitoring for a wide range of equipment. Typical uses include controlling air handling units, monitoring chiller plants including pumps and cooling towers, and serving as a central point gathering panel.

ICS Capability

As part of the ICS family and as an extension of the existing PCM, the Universal PCM provides flexible, independent control for a variety of applications. Because of its flexibility, the Universal PCM can provide control of both Trane and non-Trane products. The Universal PCM communicates with the Tracer

Hardware Description

Three versions of the PCM are available:

- Standard ambient: NEMA Type 1 metal enclosure (32 to 120°F, 0 to 49°C)
- Extended ambient: NEMA Type 1 metal enclosure (-40 to 158°F, -40 to 70°C)
- Weatherproof: NEMA Type 4 metal enclosure suitable for outdoor use (-40 to 158°F, -40 to 70°C)

An optional display and keypad include a 2-line by 20-character LCD that can display up to 32 status and control points.

For more information about the PCM, refer to Trane publication BAS-TS-43.
**Simple Building Control**

**Systems**
- Light commercial unitary systems

**Building Size**
- Small to mid-size

**Features**
- Time of day scheduling calculations
- Optimal start
- Trend logs
- Demand limiting
- Timed override
- Remote communications
- French or Spanish alternate language display
- Fahrenheit or Celsius alternate temperature display
- Alarm log
- Year 2000 compliant
- Manufactured in an ISO 9001 certified facility

**Benefits**
- Easy-to-use, affordable building control for light commercial unitary buildings
- Efficiently matches equipment operating times to comfort needs
- Provides monitoring and control either onsite or from a remote location
- Multiple language support suitable for international installations
- Allows the flexibility to temporarily turn on equipment after hours
- Reduces peak power demand without jeopardizing occupant comfort
- Can operate from the local keypad or from a personal computer

100 series (L, 100, and 100i) and the Tracer Summit family of products via an ICS communication link.

**Software Capabilities**

Like the PCM, the Universal PCM has the flexibility of customized control sequences using UPCM Edit Software. Each Universal PCM supports 25 PCL routines and 20 DDC loops, which can execute at a maximum frequency of one second.

Operator-defined PCL routines can perform logical and mathematical calculations, and can be automatically executed or initiated by an event such as a binary input change-of-state or an analog input high or low limit. Each PCL routine can be manually executed, one statement at a time, in a special test mode to allow the operator to verify program logic.

DDC loops provide proportional, integral, and derivative (PID) control of analog output devices. PID gains are operator-defined as constants or as variables calculated in the PCL routines. The operator can graphically plot each DDC loop operation via the UPCM Edit software, to assist in optimizing the performance of controlled devices. UPCM Edit software also offers the following capabilities:

- **Current point status** screens provide the status of each available hardware and software point. Diagnostic information about each hardware point is also available.
- **Optional manual overrides** on each output card are available. The manual override on a binary output card is an On/Off/Auto switch. The manual override on an analog output card is a potentiometer.
- **The optional LCD** provides monitoring capability and the ability to override points connected to a Universal PCM. This backlit, 2-line by 40-character display provides an operator interface via eight function keys, and includes four operator-definable status displays capable of displaying 16 points each. A fifth display includes Universal PCM status and diagnostics.
- **A calendar/time clock** is included with the Universal PCM. This clock allows the Universal PCM to completely recover from a power failure with the correct time and data. The clock/calendar is backed by a super capacitor for seven days under normal operating conditions.
- **Modular packaging** of the Universal PCM improves efficiency and makes job site installation easy.

**Hardware Description**

Three versions of the Universal PCM are available:

- **Standard ambient:**
  - NEMA Type 1 metal enclosure suitable for outdoor use (32 to 122°F, 0 to 50°C)
  - Extended ambient: NEMA Type 1 metal enclosure suitable for outdoor use (-40 to 158°F, -40 to 70°C)
  - Weatherproof: NEMA Type 4 metal enclosure suitable for outdoor use (-40 to 158°F, -40 to 70°C)

In addition to the enclosures listed above, a unit frame mount is also available. The Universal PCM is UL-approved as a modular energy management panel, allowing field assembly of the modular parts while maintaining UL approval.

The Universal PCM supports up to six operator-selectable, input/output cards (each with 6 points) for a total of 36 points. Any two cards (each with 6 points) can be combined for a total of 12 points. For more information about the Universal PCM, refer to Trane publication BAS-10.5.
Application-Specific Unit Control

Application-specific controllers are designed to provide custom control interfaces to specific types of equipment and applications. This contrasts with the general-purpose unit controllers, which provide flexible control options for a variety of equipment.

**Terminal Unit Controller**

The Terminal Unit Controller (TUC) is a microprocessor-based direct digital controller that can control a range of air conditioning equipment including:

- Fan coils
- Unit ventilators
- Water source heat pumps
- Blower coil air handling units

**ICS Capabilities**

When linked to a Trane Tracer system, the TUC provides building operators with centralized building management. Using a data communications link, you can connect TUCs to Tracer Summit, Tracer 100i, or Tracer L panels. These panels monitor the operation of TUC equipment and other unit controllers that are part of a Trane building management system. Tracer systems provide centralized control of equipment, including coordination of setpoints and schedules.

**Software Capabilities**

TUCs are proportional integral derivative (PID) control algorithms specifically developed for the equipment types listed above, to provide accurate and reliable control operation.

The TUC is configurable to provide several different predefined control schemes, including 2-pipe or 4-pipe valve control, face and bypass damper control, compressor control, and economizer control. The TUC is configurable for different input and output devices, such as 2-position, floating, or modulating valves.

The TUC can be applied as a field-installed controller to retrofit existing air conditioning equipment, including installation in non-Trane equipment. The TUC is also available factory-installed, wired, and tested in Trane air conditioning equipment.

**Hardware Description**

Two versions of the TUC are available for field installation:

- Standard ambient: NEMA Type 1 resin enclosure (32 to 120°F, 0 to 49°C)
- Extended ambient: NEMA Type 1 painted metal enclosure (-40 to 158°F, -40 to 70°C)

For more information about the TUC, refer to Trane publication BAS-PD-7.
Chiller Plant (Subsystem) Management

Systems
- Multiple chiller applications
- Ice storage systems
- Dual fuel chiller plants
- Comfort and industrial applications

Features
- Chiller sequencing
- Rotation changes
- Base, peak, and swing operation
- Soft start
- Individual chiller setpoint calculations
- Failure detection and recovery
- Manual override
- Chiller performance reports
- Remote communications
- Pump and tower control
- Interoperability with BACnet-compatible building management systems
- Refrigerant management monitoring and reports
- Year 2000 compliant
- Manufactured in an ISO 9001 certified facility

Benefits
- Improves chiller efficiency
- Reduces operating costs
- Balances equipment runtimes
- Provides data for management reports and maintenance
- Uses standard, tested control routines for reliable operation
- Recovers safely from power or machine failures
- Allows orderly startup and shutdown of chillers
- Protects the significant investment in the chiller plant

Lighting Control Panel

The Tracer Lighting Control Panel (LCP) is a microprocessor-based controller that manages building lighting circuits according to time of day schedules and local switch inputs.

The LCP can operate as a standalone device or interface to a Trane Tracer 100 or Tracer Summit building management system; integrating the HVAC and lighting systems. LCP accessories provide additional system flexibility and expansion capabilities.

An LCP telephone interface may complement the system by providing easy override access to any building occupant with a touch-tone telephone.

ICS Capability

A building operator can use a Tracer Summit BCU or a Tracer 100 series building management panel to monitor the status of switched inputs and lighting circuit outputs, provide time of day control, and integrate lighting control functions into the total building management system.

Software Capabilities

The LCP database groups relay outputs into independent lighting zones, and executes application programs such as blink warning and after-hours operator override.

LCP Edit Software

Lighting zone circuits can be easily rezoned without changing field wiring by using LCP Edit software.

Hardware Description

Modular design allows the LCP to be configured with as few as eight or as many as 32 relay outputs. A relay expansion card can be added anytime to extend capacity.

For more information about the LCP, refer to Trane publication BAS-PD-4.

For more information about

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Building Management Systems
DDC Chiller Sequencer

The DDC Chiller Sequencer is a sequencing panel that provides start/stop control of two chillers and associated pumps, setpoint control, lead/lag, soft loading, failure recovery, chilled water reset, and ice-making mode.

Software Capabilities

• System enable: A contact closure input to the panel selects either enable or disable mode. This input is typically connected to a time clock for time of day scheduling, but can be wired to a Manual/Off/Auto switch and thermostat to provide an ambient interface.

• Chiller/pump control: The DDC Chiller Sequencer provides binary outputs to control two chillers and two pumps.

• Lead/lag control: The operator can select manual or automatic chiller rotation through the panel keypad. Automatic rotation forces daily rotation at midnight. In the manual rotation mode, a separate manual 2-position switch is used to determine the lead chiller.

• Soft loading prevents unnecessary operation of the lag chiller on initial system startup.

• Failure recovery: In the event of a chiller failure, the lag chiller starts (through a normal Add program) when the system supply water temperature exceeds setpoint. The sequencer turns on its alarm output if:
  - the DDC Chiller Sequencer loses power
  - or the DDC Chiller Sequencer has a power failure

• Setpoint control (optional): The operator can enter the system setpoint through the sequencing panel keypad. The sequencing software sends a setpoint to each chiller. No manual setpoint coordination is required.

• Chilled water reset: resets the system setpoint based on either return water temperature or a separate reset sensor input as determined in system setup.

Hardware Description

The DDC Chiller Sequencer package consists of a Trane 20-point PCM with LCD and keypad, a matched pair of thermistor sensors, and the sequencer software.

For more information about the DDC Chiller Sequencer, refer to Trane publication BAS-MG-21.
Networked Building Control

Systems
• Applied commercial
• Unitary

Building Size:
• Mid-size to large

Features
• Chiller plant control
• High speed ARCNET or Ethernet LAN communications between panels
• Graphical user interface
• Remote communications
• Custom programming routines
• Reports and trends
• Time of day scheduling including optimum start/stop and night economizing
• Area control to coordinate HVAC equipment and lighting
• VAV air system control
• Interoperability with other non-Trane systems and subsystems using the BACnet communications protocol
• Year 2000 compliant
• Manufactured in an ISO 9001 certified facility

Benefits
• Reduced operating costs through energy management strategies
• Flexibility to grow with building expansion or remodeling
• Easy-to-learn, easy-to-use graphical user interface
• Consistent, reliable operation with standard, pre-engineered and pre-tested applications
• Easier, faster troubleshooting with in-depth data and diagnostic information
• Advance notice of system problems before they become an emergency
• Automatic printing or saving of reports for analysis or regulatory purposes
• Quick, at-a-glance graphical views of current building status
• Safety and peace of mind with multi-level operator security
• Truly open communications to BACnet-compatible subsystems or non-Trane equipment

Trane’s Integrated Comfort systems (ICS) concept incorporates the benefits of factory-mounted, wired, and tested microprocessor controls on each piece of Trane equipment described in this section. Trane Tracer building management systems link the HVAC equipment into truly integrated comfort systems that address the critical issues facing building owners, engineers, and contractors.

Chillers
Trane chillers are available with a compressor type, refrigerant type, and capacity to meet nearly any need. These chillers are designed to provide a reliable source of chilled water and are equally suited for comfort, industrial, or process applications.

Unit controllers factory-mounted on Trane chillers provide access to information and functions within each chiller. This access allows the building management products described in this catalog to optimize the operation of each chiller individually and to optimize their performance within a chiller plant.

You can link any of the chillers listed below to a Trane ICS to provide system-level monitoring, diagnostics, and control capabilities, including sequencing chillers as well as controlling pumps and cooling towers:
• CenTraVac Centrifugal Chillers
• Series R CenTraVac Rotary Chillers
• Air-cooled and water-cooled Helical Rotary Chillers

Factory-Mounted Unit Control

Trane’s Integrated Comfort systems (ICS) concept incorporates the benefits of factory-mounted, wired, and tested microprocessor controls on each piece of Trane equipment described in this section. Trane Tracer building management systems link the HVAC equipment into truly integrated comfort systems that address the critical issues facing building owners, engineers, and contractors.

Commercial Self Contained Units
Trane Commercial Self Contained air conditioners efficiently bridge the gap between unitary and central systems by factory-packaging rugged commercial components in a floor-by-floor decentralized system. Multiple, independent refrigerant circuits — using the 3-D scroll compressor — provide high performance redundancy. For application flexibility, units are factory-equipped for either water-cooled or remote air-cooled condensing.

Acoustically designed for location near occupied building spaces, one or more compact Commercial Self Contained air conditioners are commonly placed in an equipment room on each floor. Supply air is ducted to VariTrane VAV terminals. Alternatively, these units can be used with constant volume air supply systems.

Commercial Self Contained units equipped with UCMs can be connected directly to a Tracer Summit BCU or Tracer 100 series controller. These systems provide control, monitoring, and diagnostics capability—es.

For more information about Commercial Self Contained Units, refer to Trane publication PKG-OS-6.

For more information about VariTrane VAV terminal units, refer to Trane publications VAV-U-7 and VAV-US-9.
IntelliPak Rooftop Units
The 20- to 130-ton IntelliPak Rooftop is a self-contained heating and cooling air handling unit. The IntelliPak can be configured as either constant volume or variable air volume system control. The IntelliPak UCM is factory-installed on each unit, and can be connected to a Tracer Summit BCU or a Tracer 100 series controller via a Trane Communication Interface (TCI). Each system provides control, monitoring, and diagnostics for the rooftop unit.

For more information about IntelliPak Rooftops, refer to Trane publication RT-DS-8.

Voyager Rooftop Units
The 3- to 50-ton Voyager Rooftop unit is a self-contained heating and cooling air conditioner normally installed on a building’s roof. We designed the Voyager Rooftop to compete in the price-competitive market of light commercial packaged rooftops. The Voyager can be factory-configured for either constant volume or variable air volume (27½- to 50-ton Voyager Commercial only) system control. The Voyager Micro is applied on all Trane Voyager Rooftops and can be connected to a Tracer Summit BCU, a Tracer 100 series controller or a Tracker panel via a TCI. Each system provides control, monitoring, and diagnostics for the rooftop unit.

For more information about air handler control systems, refer to Trane publication CLCH-S-24, CLCH-DS-7, CLCH-DS-9, and PCC-DS-1.

Terminal Unit Controllers
The Trane Terminal Unit Controller (TUC) is a microprocessor-based, direct digital controller used on the following terminal products:

• Fan coils
• Water source heat pumps
• Unit ventilators
• Blower coil air handling units

The TUC is configurable from a list of predefined features including 2-pipe or 4-pipe valve control, face and bypass damper control, compressor control, and economizer control. The TUC can be applied as a field-installed controller to retrofit existing air conditioning equipment, including installation in non-Trane equipment. In addition, the TUC is available factory installed, wired and tested in Trane air conditioning equipment.

For more information about Terminal Unit Controllers, refer to page 28 of this catalog or Trane publication BAS-TS-7.

VAV Command Unit
The Tracer 100 series VAV Command Unit system provides control, monitoring, and diagnostics of Trane VAV terminal units. Through the VAV Command Units, the Tracer 100 series panel can maintain and monitor individual zone comfort requirements. The Tracer panel also makes the comfort system flexible to occupants’ cooling and heating requirements by grouping VAV terminal units together through software.

For more information about VAV Command Units, refer to Trane publication BAS-TS-64.
Trane Building Management Systems

The Trane Company’s line of building management systems includes a product for every control need, from a remedy for a problem area in an existing building to a comprehensive system for a major complex or campus. Trane building management system capabilities and features include:

- Scheduling for weekdays and holidays
- After-hours usage tracking
- Management reports and logs
- Dynamic and interactive color graphics
- Direct digital control and custom programming routines
- Comfort monitoring by zone
- Energy-saving software including chiller plant control, demand limiting, optimal start/stop, and night setback
- Operator interface that is easy to learn and use
- Architecturally-compatible, ergonomic design

Trane is unique in its ability to offer total Integrated Comfort systems, HVAC, controls, and building management from a single source. These systems constitute a vigorous response to today’s demands from regulatory agencies, building designers, contractors, owners, and occupants.

Pages two through nine in this catalog illustrate four typical Trane building management system applications. They demonstrate the versatility and integration capabilities of the various products in this catalog. Each Trane building management installation is designed specifically for the facility it manages and may be configured differently than the examples shown.

**Standalone Building Control**

**Benefits**

- Comprehensive set of reports to track and analyze data
- Reduced energy costs with standard, tested energy management applications
- Flexibility to provide after-hours comfort through timed override
- Quick identification of operating problems using equipment diagnostics
- Easy-to-use, dynamic color graphics (optional)

**Features**

- Time of day scheduling including optimum start/stop and night purge
- Demand limiting
- Timed override
- Reports and trends
- Remote communications
- Custom programming routines
- Chiller sequencing
- Year 2000 compliant
- Manufactured in an ISO 9001 certified facility

**Building Size**

- Mid-size to large

**Applications**

- For use with Trane Tracer systems to provide the accuracy and repeatability required by DDC control. Trane sensors are compatible with a variety of Trane building level and unit level controllers. In addition, the sensors are architecturally compatible with each other and with modern building interiors.

**Sensor Capabilities**

Trane room temperature sensors are available in several variations, and include options for setpoint adjustment and override switches. Use Trane room humidity sensors to control humidifiers and dehumidification equipment.

Controlling building humidity is an important element in maintaining indoor air quality. Trane also offers field-applied sensors to measure pressure, temperature, and humidity in air and water applications.

**CO₂ Sensor Capabilities**

Carbon dioxide is present in the air in variable amounts and can be measured in parts per million (PPM) by the Trane Carbon Dioxide (CO₂) Sensor. Elevated concentrations of carbon dioxide in a building zone can indicate a space is occupied above design conditions, or that there is a problem or deficiency with the building's ventilation system.

When connected to a Tracer building management system and the appropriate ventilation equipment, the Trane CO₂ Sensor provides building designers, operators, and owners a practical and affordable means to respond to concerns of indoor air quality and occupant comfort.

**Typical applications for the CO₂ Sensor include:**

- Monitoring and recording CO₂ levels in occupied building spaces

For more information about Trane sensors, refer to pages 29 through 32.

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**For more information about**

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| Variable Air Volume Command Unit | 30 |
| VariTrane Variable Air Volume Terminal Unit | 29 |

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**Trane Sensors**

Controlling the comfort in a building space begins with Trane sensors. We designed our sensors for use with Trane Tracer systems to provide the accuracy and repeatability required by DDC control. Trane sensors are compatible with a variety of Trane building level and unit level controllers. In addition, the sensors are architecturally compatible with each other and with modern building interiors.

**Sensor Capabilities**

Trane room temperature sensors are available in several variations, and include options for setpoint adjustment and override switches. Use Trane room humidity sensors to control humidifiers and dehumidification equipment.

Controlling building humidity is an important element in maintaining indoor air quality. Trane also offers field-applied sensors to measure pressure, temperature, and humidity in air and water applications.

**CO₂ Sensor Capabilities**

Carbon dioxide is present in the air in variable amounts and can be measured in parts per million (PPM) by the Trane Carbon Dioxide (CO₂) Sensor. Elevated concentrations of carbon dioxide in a building zone can indicate a space is occupied above design conditions, or that there is a problem or deficiency with the building’s ventilation system.

When connected to a Tracer building management system and the appropriate ventilation equipment, the Trane CO₂ Sensor provides building designers, operators, and owners a practical and affordable means to respond to concerns of indoor air quality and occupant comfort.

**Typical applications for the CO₂ Sensor include:**

- Monitoring and recording CO₂ levels in occupied building spaces

For more information on the CO₂ Sensor, refer to Trane publication BAS-P08.
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