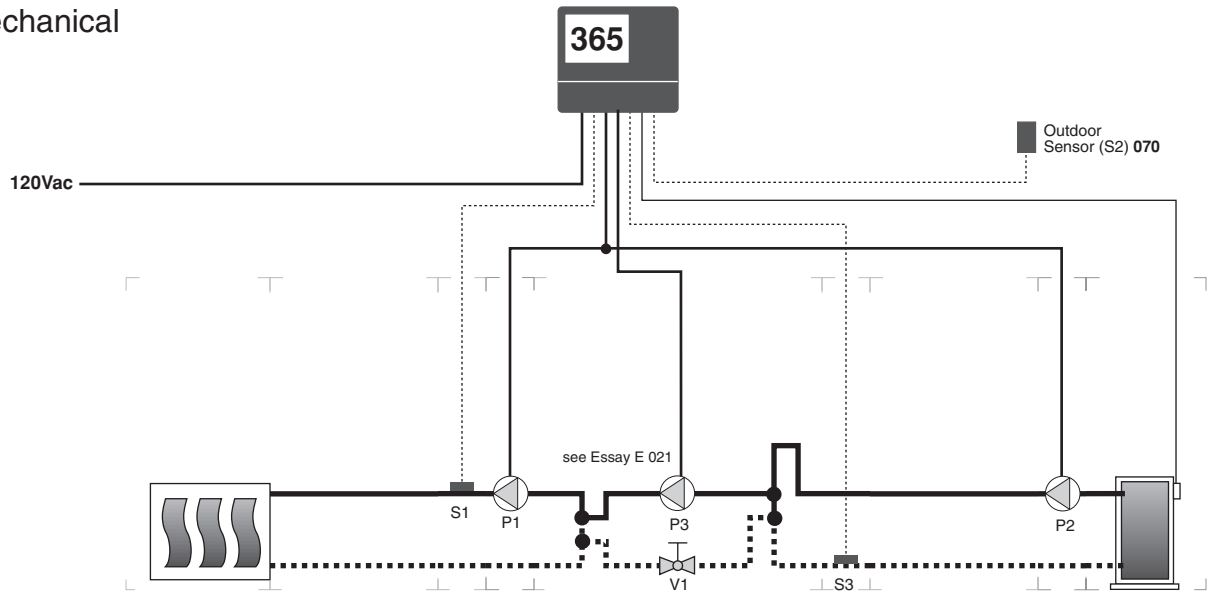
tekmar® - Application

Mixing Control 365

A 365-1

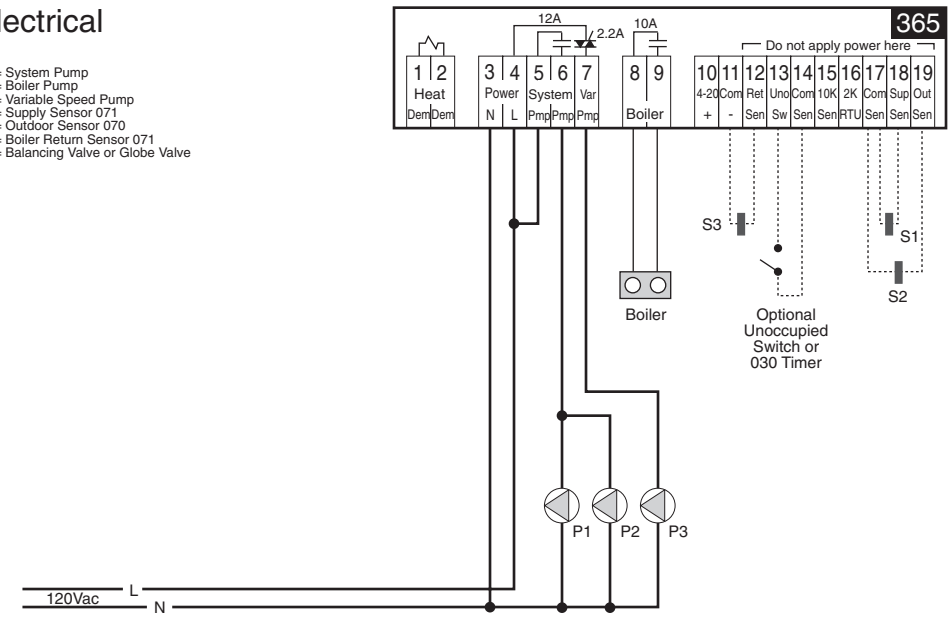
07/99

Mechanical



Electrical

P1 = System Pump
P2 = Boiler Pump
P3 = Variable Speed Pump
S1 = Supply Sensor 071
S2 = Outdoor Sensor 070
S3 = Boiler Return Sensor 071
V1 = Balancing Valve or Globe Valve



Note: This is only a concept drawing. Designers must determine whether this system will work in each application and must ensure compliance with code requirements. Necessary auxiliary equipment and safety devices must be added.

Operation

The tekmar Mixing Control 365 regulates the indoor air temperature of the heating zone by the amount of hot boiler water injected into the continuously circulating system loop. The pump that injects hot boiler water into the system runs at varying speeds depending on the load requirement. The water temperature of the heating zone is regulated based on the outdoor air temperature . Protection of the boiler from cold return water is an additional feature when the Boiler Return Sensor 071 is used.

Specifications

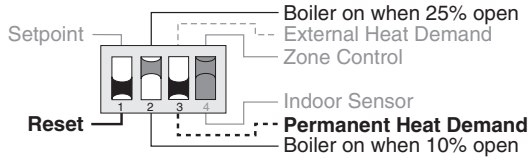
The following are minimum recommended specifications for the control in this application.

- The heating system shall have a boiler pump (P2) in the boiler loop and a system pump (P1) in the system supply loop.
- The variable speed pump (P3) shall be a permanent capacitor, impedance protected circulator pump no larger than 1/6 hp.
- The control shall have an Unoccupied (setback) input to enable the control's Unoccupied temperature dial.
- The control shall have an adjustable Minimum Boiler Return temperature setting to help prevent cold shock to the boiler and condensation of flue gases.
- The control shall have an adjustable Maximum Supply water temperature setting to help protect system components from overheating.
- When the control is operated in reset mode, the heating system supply water temperature shall be based on the outdoor air temperature and the control's Heating Curve (reset ratio) and the Occupied or Unoccupied dial settings.
- The Occupied and Unoccupied (when in setback) temperature dial setting shall be the control's Warm Weather Shut Down (WWSD) point.
- The control shall have a test button which activates a pre-programmed test sequence to test all control inputs and outputs.
- The control shall be microprocessor-based, have one SPST internal relay with 12 amp (resistive) and one SPST internal relay with 10 amp (resistive) isolated contacts for outputs, and have indicator lights for control function and status.
- The control shall have a variable speed output capable of driving a maximum 2.2 amp permanent capacitor, impedance protected 120Vac circulator pump, and a 4-20mA output to drive 4-20mA, 1-5 Vdc or 2-10 Vdc devices.
- The control shall have CSA (Canadian Standards Association) and UL (Underwriters Laboratory) approvals.
- The control shall continuously monitor its sensors and provide an LED error message if a sensor is shorted or open circuited.
- During WWSD the system pump, variable speed pump and boiler pump are exercised once every three days to help prevent seizure during longer idle periods.
- The installation location must be maintained within the ambient temperature and humidity ranges specified in the D 365 Brochure for this control, with the installer ensuring that the control and its wiring are isolated and/or shielded from strong sources of electromagnetic noise.
- The control components required from tekmar are one Mixing Control 365 and one Sensor 071 (boiler return).

Settings

Mixing Control 365	Adjustment Range	Recommended Initial Setting
Heating Curve	0.4 to 3.6	
Maximum System Supply/Setpoint	100 to 200°F (38 to 93°C)	
Minimum Boiler Return	Off, 50 to 150°F (Off, 16 to 66°C)	
Motor Speed/Pump Response	30 to 230 seconds	40 seconds
Occupied	35 to 105°F (2 to 41°C)	
Unoccupied	35 to 105°F (2 to 41°C)	

Mixing Control 365 DIP switch settings for this application.



= required setting for this application.

= optional setting for this application.

= does not matter, switch not used for this application. (see Data Brochure D 365)

Additional Information

- For control installation and testing instructions see Brochures D 001 and D 365.
- For other control applications see Application Register A 000.
- For control theory and system integration details see Essays E 001, E 002 and E 021.

tekmar Control Systems

tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
Head Office: 5100 Silver Star Road
Vernon, B.C. Canada V1B 3K4
Tel. (250) 545-7749 Fax. (250) 545-0650
Web Site: www.tekmarcontrols.com

All specifications are subject to change without notice.
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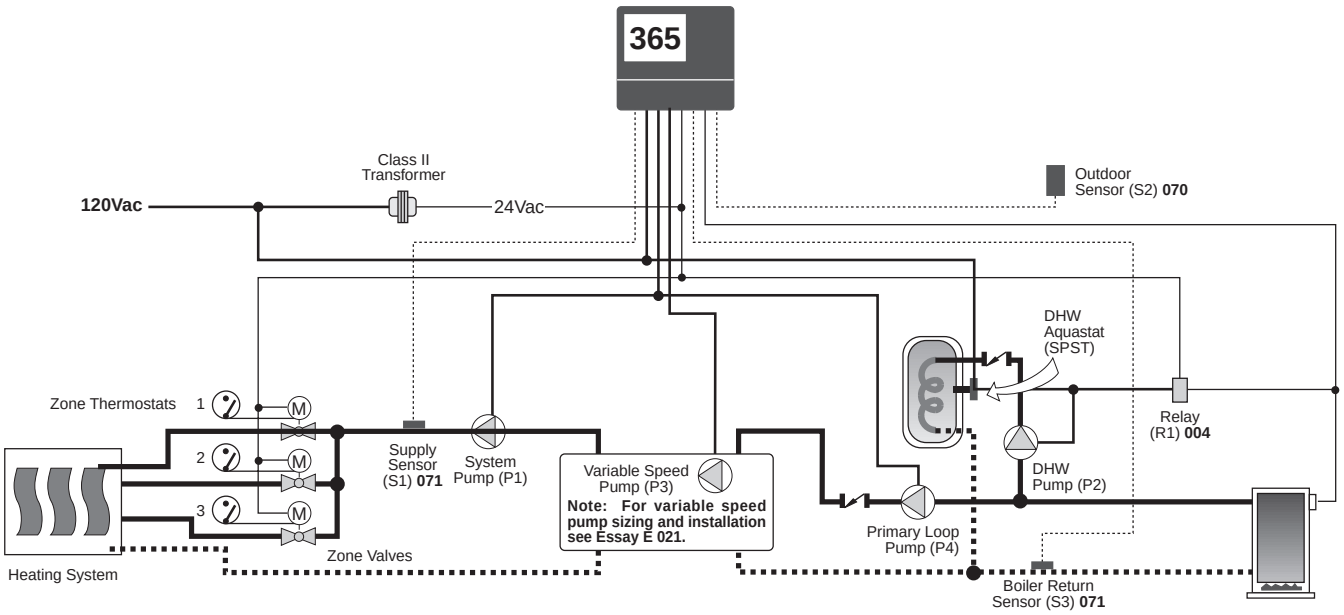
tekmar® - Application

Mixing Control 365

A 365-2

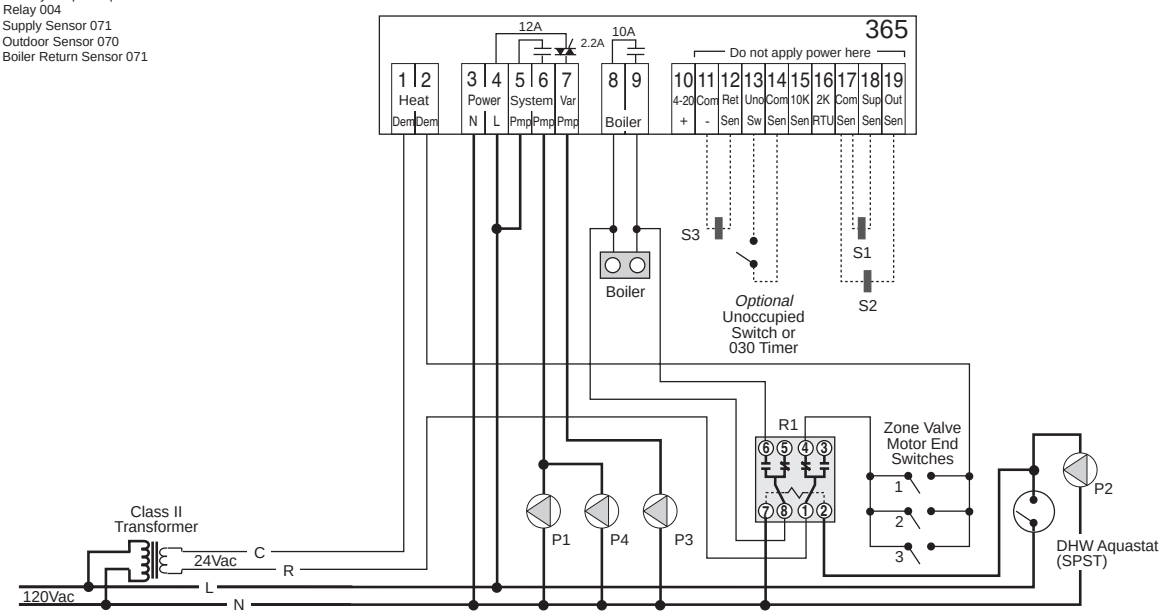
02/94

Mechanical



Electrical

P1 = System Pump
P2 = DHW Pump
P3 = Variable Speed Pump
P4 = Primary Loop Pump
R1 = Relay 004
S1 = Supply Sensor 071
S2 = Outdoor Sensor 070
S3 = Boiler Return Sensor 071



Note: This is only a concept drawing. Designers must determine whether this system will work in each application and must ensure compliance with code requirements. Necessary auxiliary equipment and safety devices must be added.

Operation

The tekmar Mixing Control 365 regulates the amount of hot water injected into the system supply loop through a pump which is driven at varying speeds. Domestic hot water has priority in this system, with both the system and primary loop pumps being turned off when DHW is generated. Protection of the boiler from cold return water is an additional feature when the boiler return sensor 071 is used.

Specifications

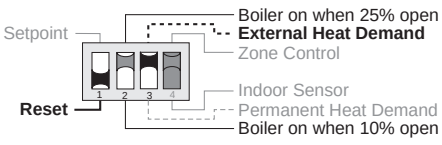
The following are minimum recommended specifications for the control in this application.

- The heating system shall have a primary loop pump (P4) in the boiler loop and a system pump (P1) in the supply loop of the heating system.
- The variable speed pump (P2) shall be a permanent capacitor, impedance protected circulator pump no larger than 1/6 hp.
- During domestic hot water (DHW) demand, all pumps shall turn off except the DHW pump (P3).
- The pumps and the boiler shall be turned off until there is a "call for heat" from the zone valve motor end switches and the outdoor air temperature is colder than the control's Warm Weather Shut Down (WWSD) point.
- The control shall have an adjustable Unoccupied (setback) input to enable the control's Unoccupied temperature dial.
- The control shall have an adjustable Minimum Boiler Return temperature setting to help prevent cold shock to the boiler and condensation of flue gases.
- The control shall have an adjustable Maximum Supply water temperature setting to help protect system components from overheating.
- When the control is operated in reset mode, the heating system supply water temperature shall be based on the outdoor air temperature and the control's Heating Curve (reset ratio) and the Occupied or Unoccupied dial settings.
- The Occupied and Unoccupied (when in setback) temperature dial setting shall be the control's Warm Weather Shut Down (WWSD) point.
- The control shall have a test button which activates a pre-programmed test sequence to test all control inputs and outputs.
- The control shall be microprocessor-based, have one SPST internal relay with 12 amp (resistive) and one SPST internal relay with 10 amp (resistive) isolated contacts for outputs, and have indicator lights for control function and status.
- The control shall have a variable speed output capable of driving a maximum 2.2 amp permanent capacitor, impedance protected 120Vac circulator pump, and a 4-20mA output to drive 4-20mA, 1-5 Vdc or 2-10 Vdc devices.
- The control shall have CSA (Canadian Standards Association) and UL (Underwriters Laboratory) approvals.
- The control shall continuously monitor its sensors and provide an LED error message if a sensor is shorted or open circuited.
- During WWSD, the system pump, variable speed pump and primary loop pump are exercised once every three days to help prevent seizure during longer idle periods.
- The installation location must be maintained within the ambient temperature and humidity ranges specified in the D 365 Brochure for this control, with the installer ensuring that the control and its wiring are isolated and/or shielded from strong sources of electromagnetic noise.
- The control components required from tekmar are one Mixing Control 365, one Relay 004 and one Sensor 071 (boiler return).

Settings

Mixing Control 365	Adjustment Range	Recommended Initial Setting
Heating Curve	0.4 to 3.6	
Maximum System Supply/Setpoint	100 to 200°F (38 to 93°C)	
Minimum Boiler Return	Off, 50 to 150°F (Off, 16 to 66°C)	
Motor Speed/Pump Response	30 to 230 seconds	40 seconds
Occupied	35 to 105°F (2 to 41°C)	
Unoccupied	35 to 105°F (2 to 41°C)	

Mixing Control 365 DIP switch settings for this application.



= required setting for this application.

= optional setting for this application.

= does not matter, switch not used for this application. (see Data Brochure D 365)

Additional Information

- For control installation and testing instructions see Brochures D 001 and D 365.
- For other control applications see Application Register A 000.
- For control theory and system integration details see Essays E 001, E 002 and E 021.

In North America: tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
Head Office: 5100 Silver Star Road
Vernon, B.C. Canada V1B 3K4
Tel. (250) 545-7749 Fax. (250) 545-0650

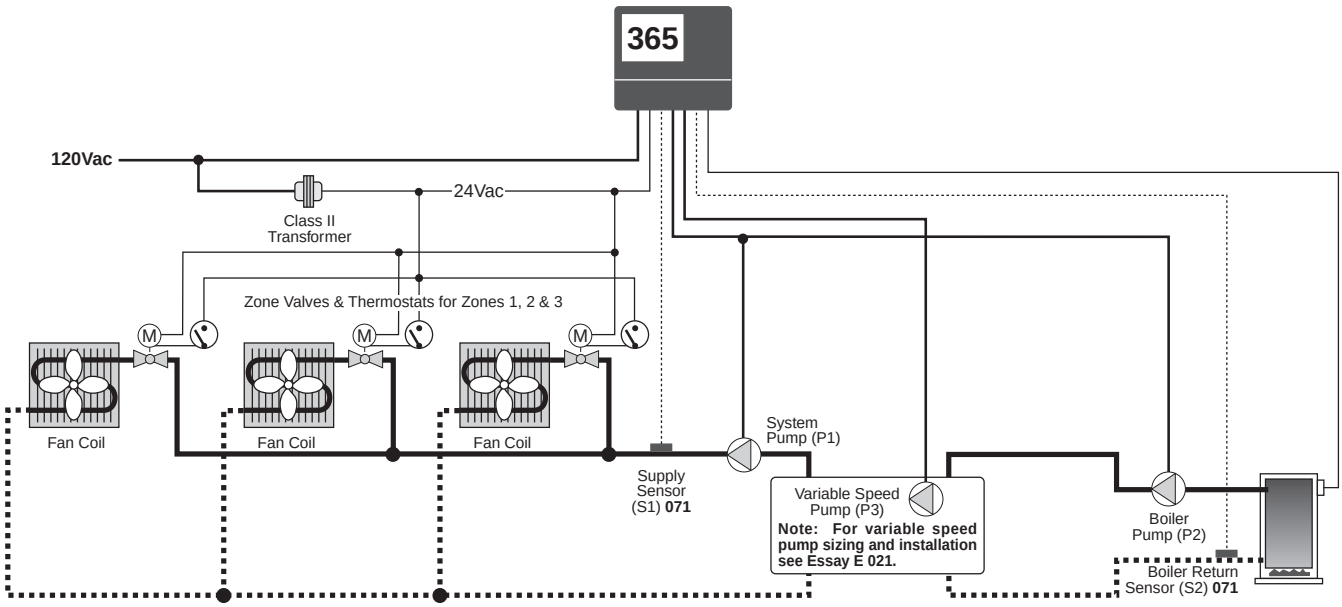
tekmar® - Application

Mixing Control 365

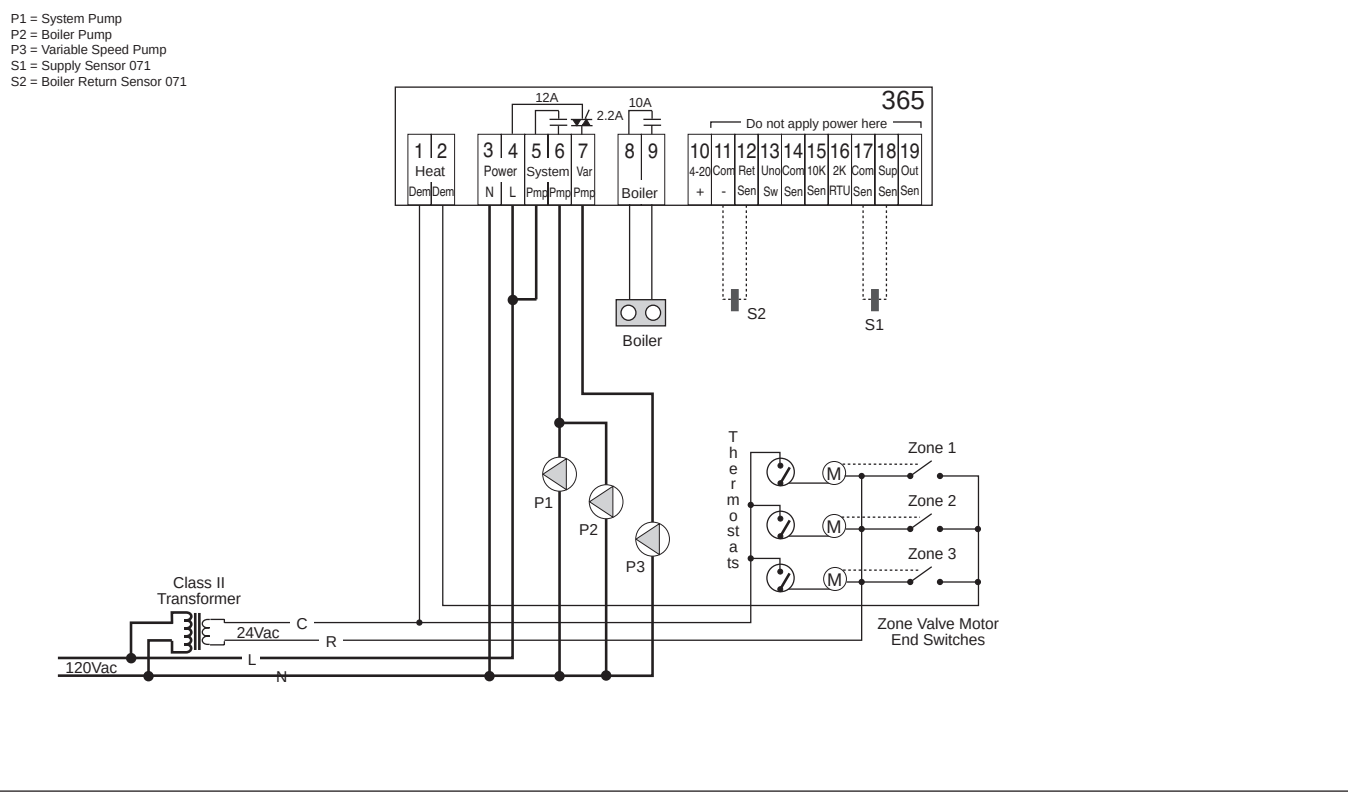
A 365-3

12/93

Mechanical



Electrical



Note: This is only a concept drawing. Designers must determine whether this system will work in each application and must ensure compliance with code requirements. Necessary auxiliary equipment and safety devices must be added.

Operation

The tekmar Mixing Control 365 is used in this application to maintain a setpoint temperature in the system loop. The amount of hot boiler water injected into the system loop is controlled through a pump which is driven at varying speeds depending on demand. Protection of the boiler from cold return water is an additional feature when the boiler return sensor 071 is used.

Specifications

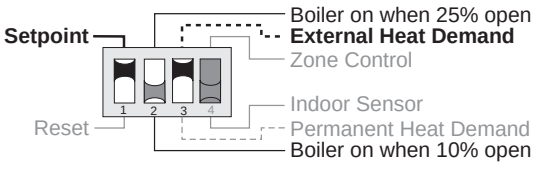
The following are minimum recommended specifications for the control in this application.

- The heating system shall have a boiler pump (P2) in the boiler loop and a system pump (P1) in the system supply loop.
- The variable speed pump (P3) shall be a permanent capacitor, impedance protected circulator pump no larger than 1/6 hp.
- The variable speed pump shall be sized to ensure that the control's variable speed output is 100% at system design temperatures.
- The pumps and the boiler shall be turned off until there is a “call for heat” from the zone valve motor end switches. The boiler shall remain off until the system loop temperature is below the setpoint temperature.
- The control shall have an adjustable Minimum Boiler Return temperature setting to help prevent cold shock to the boiler and condensation of flue gases.
- The heating system supply water temperature shall be based on the control's setpoint temperature dial setting.
- The control shall have a test button which activates a pre-programmed test sequence to test all control inputs and outputs.
- The control shall be microprocessor-based, have one SPST internal relay with 12 amp (resistive) and one SPST internal relay with 10 amp (resistive) isolated contacts for outputs, and have indicator lights for control function and status.
- The control shall have a variable speed output capable of driving a 2.2 amp permanent capacitor, impedance protected 120Vac circulator pump, and a 4-20mA output to drive 4-20mA, 1-5 Vdc or 2-10 Vdc devices.
- The control shall have CSA (Canadian Standards Association) and UL (Underwriters Laboratory) approvals.
- The control shall continuously monitor its sensors and provide an LED error message if a sensor is shorted or open circuited.
- The installation location must be maintained within the ambient temperature and humidity ranges as specified in the D 365 brochure for this control, with the installer ensuring that the control and its wiring are isolated and/or shielded from strong sources of electromagnetic noise.
- The control components required from tekmar are a Mixing Control 365 and one Supply Sensor 071 (boiler return).

Settings

Mixing Control 365	Adjustment Range	Recommended Initial Setting
Maximum System Supply/Setpoint	100 to 200°F (38 to 93°C)	
Minimum Boiler Return	Off, 50 to 150°F (Off, 16 to 66°C)	
Motor Speed/Pump Response	30 to 230 seconds	40 seconds

Mixing Control 365 DIP switch settings for this application.



= required setting for this application.

= optional setting for this application.

= does not matter, switch not used for this application. (see Data Brochure D 365)

Additional Information

- For control installation and testing instructions see Brochures D 001 and D 365.
- For other control applications see Application Register A 000.
- For control theory and system integration details see Essays E 001, E 002 and E 021.

In North America: tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
Head Office: 5100 Silver Star Road
Vernon, B.C. Canada V1B 3K4
Tel. (250) 545-7749 Fax. (250) 545-0650

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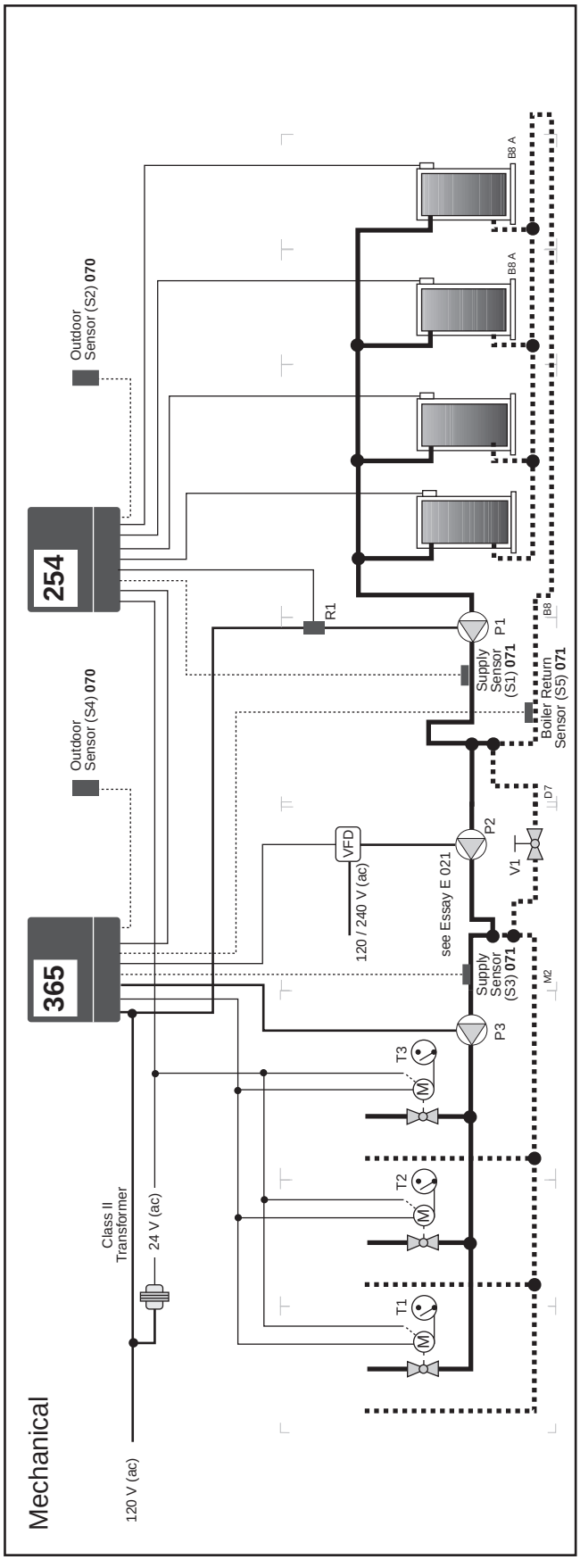
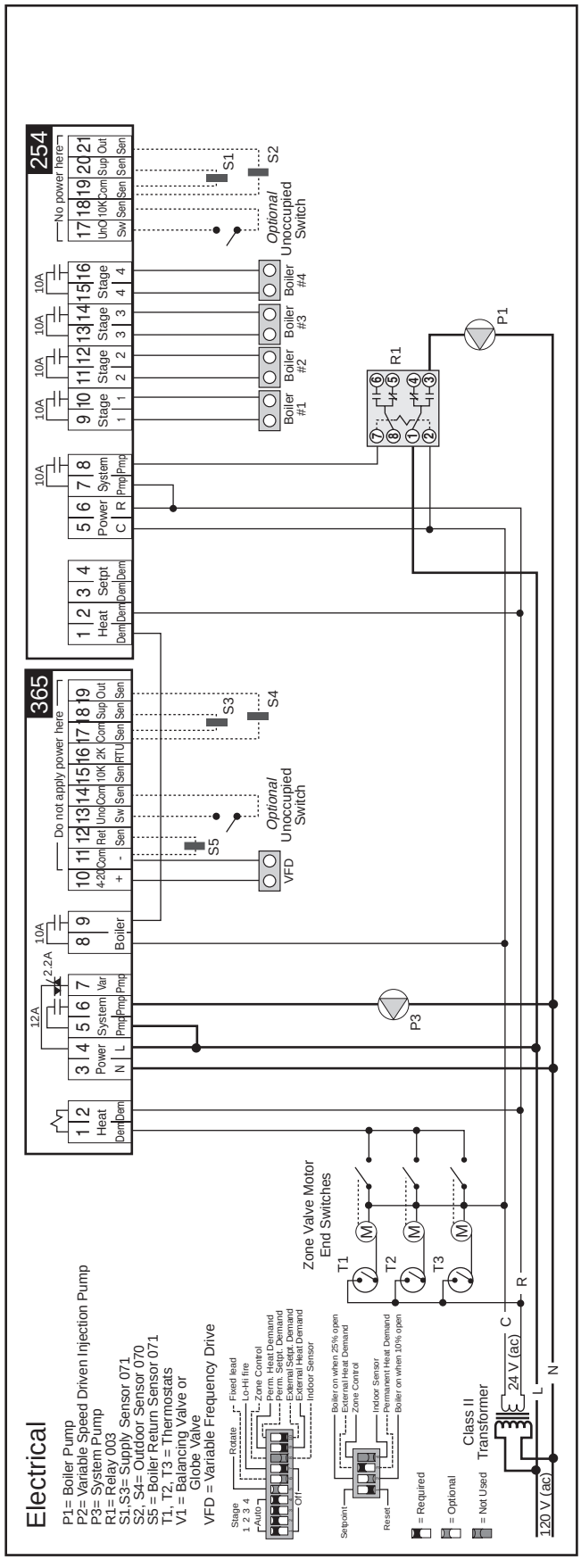
Mixing Control 365 & Four Stage Boiler Control 254

A 365-4

12/96



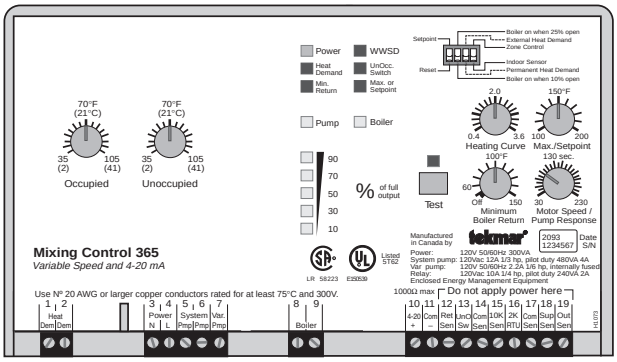


Note: This is only a concept drawing. The designer must determine whether this application will work in his system and must ensure compliance with code requirements. Necessary auxiliary equipment, isolation relays (for loads greater than the specified tekmar internal relay ratings), and other safety and limit devices must be added.

Technical Data

Mixing Control 365 *Variable Speed / 4 - 20 mA*

Literature	—	A 000, A 365's, E 021, D 365, D 001, D 05, D 06, D 070, D 074
Control	—	Microprocessor PID control; This is **not a safety (limit) control**.
Packaged weight	—	3.3 lb. (1500 g), Enclosure A, PVC plastic
Dimensions	—	6-5/8" H x 7-9/16" W x 2-13/16" D (170 x 193 x 72 mm)
Approvals	—	CSA, UL listed, meets ICES & FCC regulations for EMI/RFI.
Ambient conditions	—	Indoor use only, 30 to 105°F (0 to 40°C), < 90% RH non-condensing.
Power supply	—	120 V ±10% 50/60 Hz 300 VA
System Pump	—	120 V (ac) 12 A 1/3 hp, pilot duty 480 VA 4 A
Variable Speed Pump	—	120 V 50/60 Hz 2.2 A 1/6 hp, internally fused
Boiler Demand	—	120 V (ac) 10 A 1/3 hp, pilot duty 240 VA 2 A
Sensors	—	NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) ß=3892
included:		Outdoor Sensor 070 and Universal Sensor 071.
optional:		10K Sensor or 2K RTU.
Occupied	—	35 to 105°F (2 to 41°C)
Unoccupied	—	35 to 105°F (2 to 41°C)
Heating Curve	—	0.4 to 3.6
Maximum Supply	—	100 to 190°F, Off (38 to 88°C, Off)
Setpoint & UnOcc	—	35 to 200°F (2 to 93°C)
Min. Boiler Return	—	Off, 60 to 150°F (Off, 16 to 66°C)
Motor Speed	—	30 to 230 seconds



System Operation & Specifications

The Mixing Control 365 and the Four Stage Boiler Control 254 are combined to stage and rotate four boilers as well as provide Boiler Protection and full Outdoor Reset of the system water.

Piping and Heat Source Details The heating system is piped in a primary - secondary arrangement using a Variable Speed Driven Injection pump as the mixing device. The boiler loop is piped using reverse return piping in order to provide equal flow through all four boilers. The system loop is piped using a two pipe direct return arrangement with the zones being controlled by zone valves.

Warm Weather Shut Down (WWSD) When the outdoor temperature rises above the WWSD point of the controls, the controls enter the WWSD mode of operation. They continue to monitor their sensors but do not operate the heating system until the outdoor temperature falls below the WWSD point.

Mixing Operation When a thermostat opens a zone valve, the end switch provides a Heat Demand signal to the 365. Once the 365 receives a Heat Demand, it closes its *System Pump* contact and enables the system pump (P3). The 365 then starts the Variable Speed Driven Injection Pump (P2) and increases its speed until the System Supply Sensor 071 (S3) is satisfied according to the requirements of the Heating Curve. If the Variable Speed Driven Injection Pump exceeds the *Boiler On* dip switch setting the 365 will close its *Boiler* contact. When the *Boiler* contact closes, the 365 provides a Heat Demand signal to the 254.

Boiler Operation When the 254 receives a Heat Demand from the 365, the 254 enables the boiler loop pump (P1). It then uses the information from the Outdoor Sensor 070 (S2) and the Boiler Supply Sensor 071 (S1) to stage the boilers and adjust the supply water temperature according to the requirements of the Heating Curve.

Boiler Protection The 365 offers Boiler Protection through the use of the optional Boiler Return Sensor 071 (S5). As the return temperature approaches the *Minimum Boiler Return* setting, the 365 reduces the speed of the Variable Speed Driven Injection Pump (P2) in order to allow more water to recirculate through the boiler loop.

System Protection When operating in the *Reset* mode, the 365 is capable of providing System Protection. As the system supply temperature approaches the *Max./Setpoint* setting, the 365 reduces the speed of the Variable Speed Driven Injection Pump in order to maintain a system supply temperature below the *Max./Setpoint* setting. This prevents the system components from being exposed to excessive temperatures.

Boiler Rotation The 254 provides a boiler rotation option. When this option is used, the firing sequence of the boilers is changed based on an Equal Run Time logic. The 254 keeps track of the accumulated running time of each boiler and rotates them accordingly. For more information on Equal Run Time Rotation, refer to Data Brochure D 254 and Application Catalog A 000.

Additional Functions Additional functions are listed in the table in the Heating Controls and Boiler / DHW Controls section of the Product Catalog I 000 and the Application Catalog A 000.

tekmar® Control Systems

tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
Head Office: 5100 Silver Star Road
Vernon, B.C. Canada V1B 3K4
Tel. (250) 545-7749 Fax. (250) 545-0650

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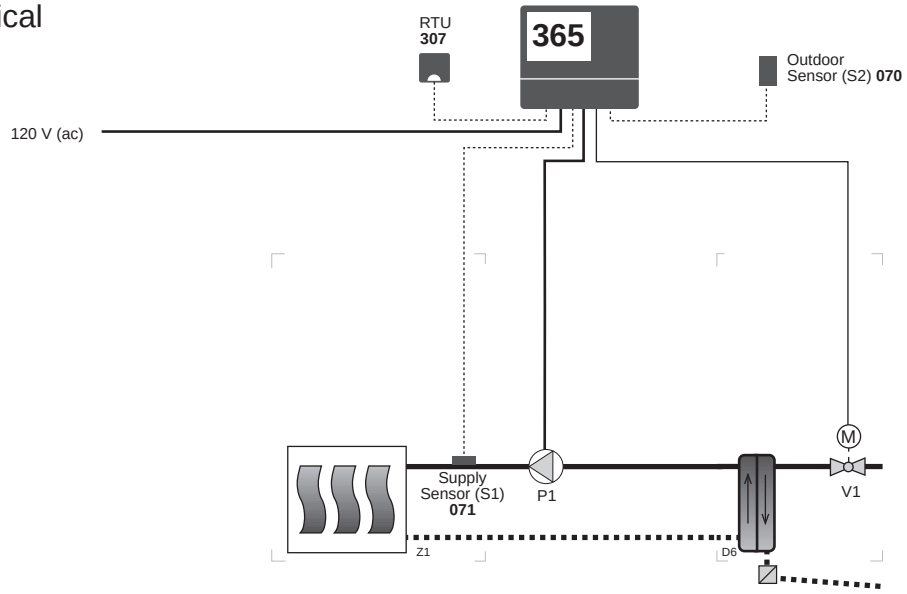
Mixing Control 365

A 365-5

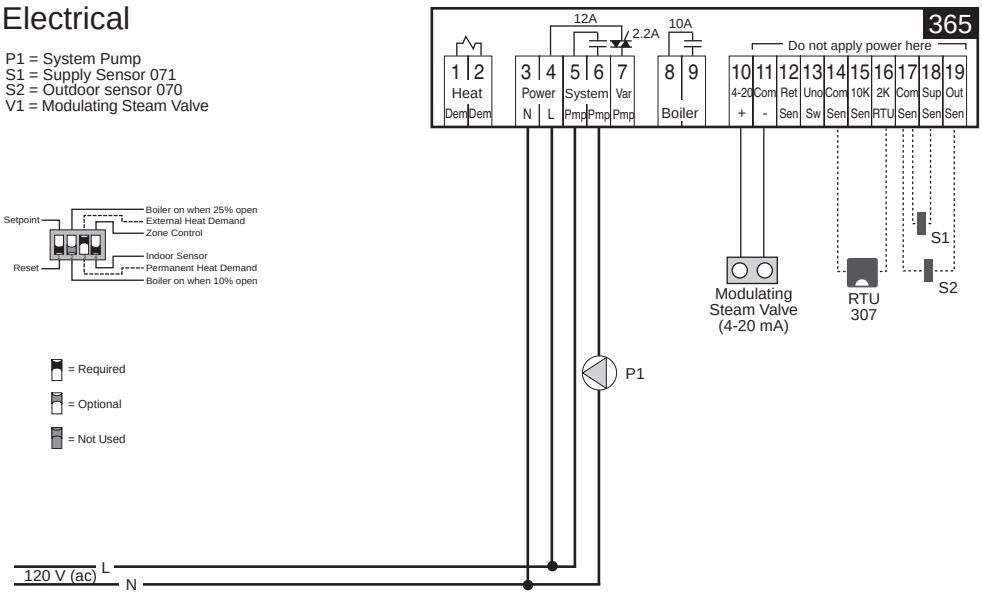
12/96

Mechanical



Electrical

P1 = System Pump
S1 = Supply Sensor 071
S2 = Outdoor sensor 070
V1 = Modulating Steam Valve

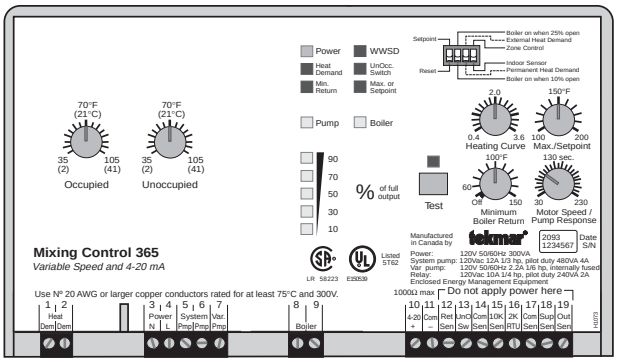


Note: This is only a concept drawing. The designer must determine whether this application will work in his system and must ensure compliance with code requirements. Necessary auxiliary equipment, isolation relays (for loads greater than the specified tekmar internal relay ratings), and other safety and limit devices must be added.

Technical Data

Mixing Control 365 *Variable Speed / 4 - 20 mA*

Literature	—	A 000, A 365's, E 021, D 365, D 001, D 05, D 06, D 070, D 074
Control	—	Microprocessor PID control; This is **not a safety (limit) control**.
Packaged weight	—	3.3 lb. (1500 g), Enclosure A, PVC plastic
Dimensions	—	6-5/8" H x 7-9/16" W x 2-13/16" D (170 x 193 x 72 mm)
Approvals	—	CSA, UL listed, meets ICES & FCC regulations for EMI/RFI.
Ambient conditions	—	Indoor use only, 30 to 105°F (0 to 40°C), < 90% RH non-condensing.
Power supply	—	120 V ±10% 50/60 Hz 300 VA
System Pump	—	120 V (ac) 12 A 1/3 hp, pilot duty 480 VA 4 A
Variable Speed Pump	—	120 V 50/60 Hz 2.2 A 1/6 hp, internally fused
Boiler Demand	—	120 V (ac) 10 A 1/3 hp, pilot duty 240 VA 2 A
Sensors	—	NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) ß=3892
included:		Outdoor Sensor 070 and Universal Sensor 071.
optional:		10K Sensor or 2K RTU.
Occupied	—	35 to 105°F (2 to 41°C)
Unoccupied	—	35 to 105°F (2 to 41°C)
Heating Curve	—	0.4 to 3.6
Maximum Supply	—	100 to 190°F, Off (38 to 88°C, Off)
Setpoint & UnOcc	—	35 to 200°F (2 to 93°C)
Min. Boiler Return	—	Off, 60 to 150°F (Off, 16 to 66°C)
Motor Speed	—	30 to 230 seconds



System Operation & Specifications

The Mixing Control 365 controls a 2-way modulating steam valve in order to provide a reset supply temperature using the outdoor air temperature and Indoor Temperature Feedback.

Piping and Heat Source Details A steam to water heat exchanger is used to transfer heat from a steam source to the fluid in the heating system. The modulating steam valve must linearly increase the flow of steam with change of control output.

Warm Weather Shut Down (WWSD) When the outdoor temperature rises above the RTU setting and the heating zone is satisfied, the control enters the WWSD mode of operation. In this mode of operation, the control still monitors its sensor inputs but does not provide heat to the system.

System Operation During the heating season, the system pump (P1) runs continuously. The 365 calculates the required supply water temperature based on the outdoor air temperature provided by the Outdoor Sensor 070 (S2) and the indoor air temperature provided by the RTU. The position of the steam valve is then modulated in order to satisfy the Supply Sensor 071 (S1).

System Protection When operating in the *Reset* mode, the 365 is capable of providing System Protection. As the system supply temperature approaches the *Max./Setpoint* setting, the 365 begins closing the steam valve in order to maintain a system supply temperature below the *Max./Setpoint* setting. This prevents the system components from being exposed to excessive temperatures.

Additional Functions Additional functions are listed in the table in the Heating Controls section of the Product Catalog I 000 and the Application Catalog A 000.

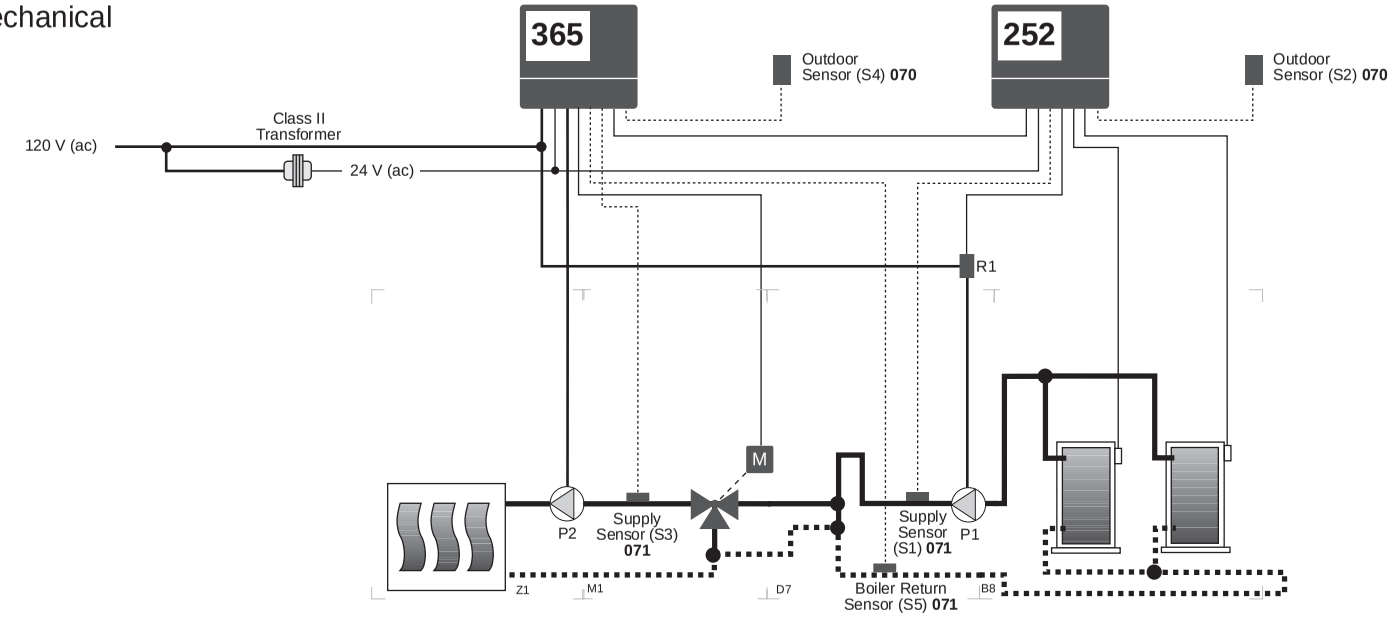
tekmar Control Systems

tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
Head Office: 5100 Silver Star Road
Vernon, B.C. Canada V1B 3K4
Tel. (250) 545-7749 Fax. (250) 545-0650

tekmar® - Application

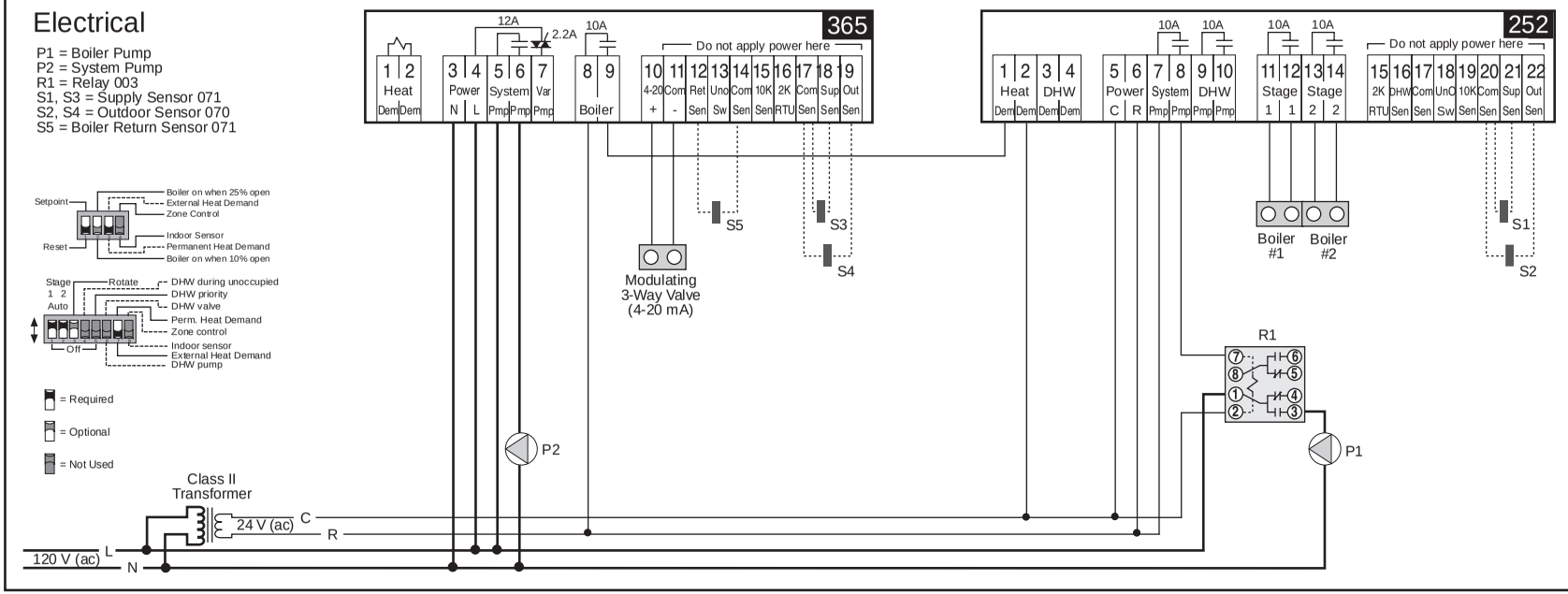
Mixing Control 365 & Two Stage Boiler & DHW Control 252

Mechanical



Electrical

P1 = Boiler Pump
P2 = System Pump
R1 = Relay 003
S1, S3 = Supply Sensor 071
S2, S4 = Outdoor Sensor 070
S5 = Boiler Return Sensor 071



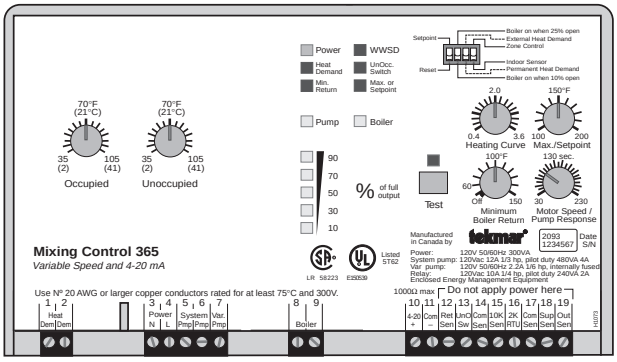
Note: This is only a concept drawing. The designer must determine whether this application will work in his system and must ensure compliance with code requirements. Necessary auxiliary equipment, isolation relays (for loads greater than the specified tekmar internal relay ratings), and other safety and limit devices must be added.

A 365-6
12/96

Technical Data

Mixing Control 365 *Variable Speed / 4 - 20 mA*

Literature	—	A 000, A 365's, E 021, D 365, D 001, D 05, D 06, D 070, D 074
Control	—	Microprocessor PID control; This is **not a safety (limit) control**.
Packaged weight	—	3.3 lb. (1500 g), Enclosure A, PVC plastic
Dimensions	—	6-5/8" H x 7-9/16" W x 2-13/16" D (170 x 193 x 72 mm)
Approvals	—	CSA, UL listed, meets ICES & FCC regulations for EMI/RFI.
Ambient conditions	—	Indoor use only, 30 to 105°F (0 to 40°C), < 90% RH non-condensing.
Power supply	—	120 V ±10% 50/60 Hz 300 VA
System Pump	—	120 V (ac) 12 A 1/3 hp, pilot duty 480 VA 4 A
Variable Speed Pump	—	120 V 50/60 Hz 2.2 A 1/6 hp, internally fused
Boiler Demand	—	120 V (ac) 10 A 1/3 hp, pilot duty 240 VA 2 A
Sensors	—	NTC thermistor, 10 kΩ @ 77°F (25°C ±0.2°C) ß=3892
included:		Outdoor Sensor 070 and Universal Sensor 071.
optional:		10K Sensor or 2K RTU.
Occupied	—	35 to 105°F (2 to 41°C)
Unoccupied	—	35 to 105°F (2 to 41°C)
Heating Curve	—	0.4 to 3.6
Maximum Supply	—	100 to 190°F, Off (38 to 88°C, Off)
Setpoint & UnOcc	—	35 to 200°F (2 to 93°C)
Min. Boiler Return	—	Off, 60 to 150°F (Off, 16 to 66°C)
Motor Speed	—	30 to 230 seconds



System Operation & Specifications

The Mixing Control 365 and Two Stage Boiler & DHW Control 252 combine to provide Mixing Reset, Boiler Reset and Boiler Protection.

Piping and Heat Source Details The system is piped in a primary - secondary arrangement. The boiler loop is piped using the reverse return method in order to provide equal flow through both boilers. The system loop uses a modulating 3-way mixing valve as the mixing device to control the loop temperature.

Warm Weather Shut Down (WWSD) When the outdoor air temperature exceeds the WWSD point, the controls enter a WWSD mode of operation. In this mode the controls continue to monitor their sensors but do not operate the heating system. If the controls remain in WWSD for an extended period of time, they will Exercise the various pieces of equipment in order to prevent premature failures.

Mixing Operation The 365 is configured to deliver a Reset Supply Water temperature to the system based on the outdoor air temperature. The outdoor air temperature is provided by the Outdoor Sensor 070 (S4) and the supply water temperature is provided by the System Supply Sensor 071 (S3). The 365 uses the information provided by the Supply Sensor 071 (S3) in order to modulate the position of the mixing valve. Once the mixing valve is opened beyond the *Boiler On* dip switch setting, the 365 closes its boiler contacts and supplies a Heat Demand to the 252.

Boiler Operation Once the 252 receives a Heat Demand signal from the 365, it closes its *System Pump* contacts and enables the boiler loop pump (P1). The 252 then stages the two boilers using PID logic in order to provide a Reset Supply Temperature. To achieve this, the 252 monitors the outdoor air temperature through the use of an Outdoor Sensor 070 (S2) and then calculates an appropriate supply water temperature based on the requirements of the installer / operator adjusted *Heating Curve*, *Minimum Supply* setting, and the Warm Weather Shut Down point. The 252 also stages the boilers based on the information provided by the Boiler Supply Sensor 071 (S1) and PID staging logic. Also, the 252 is capable of Rotating the boilers based on an Equal Run Time Rotation logic. For more information on PID logic and Equal Run Time Rotation refer to Data Brochure D 252 and Application Catalog A 000.

Boiler Protection In this application, the 365 provides Boiler Protection through the use of the optional Boiler Return Sensor 071 (S5). As the return temperature approaches the *Minimum Boiler Return* setting the 365 modulates the mixing valve closed. This causes more of the water to recirculate through the boiler loop allowing the boiler loop temperature to rise.

System Protection When operating in the *Reset* mode, the 365 is capable of providing System Protection. As the system supply temperature approaches the *Max./Setpoint* setting, the 365 begins closing the mixing valve in order to maintain a system supply temperature below the *Max./Setpoint* setting. This prevents the system components from being exposed to excessive temperatures.

Additional Functions Additional functions are listed in the table in the Heating Controls and Boiler / DHW Controls sectionsw of the Product Catalog I 000 and the Application Catalog A 000.

tekmar® Control Systems

tekmar Control Systems Ltd., Canada
tekmar Control Systems, Inc., U.S.A.
Head Office: 5100 Silver Star Road
Vernon, B.C. Canada V1B 3K4
Tel. (250) 545-7749 Fax. (250) 545-0650