# tekmar® Application Brochure

## Boiler Control 284

Multi-Staging

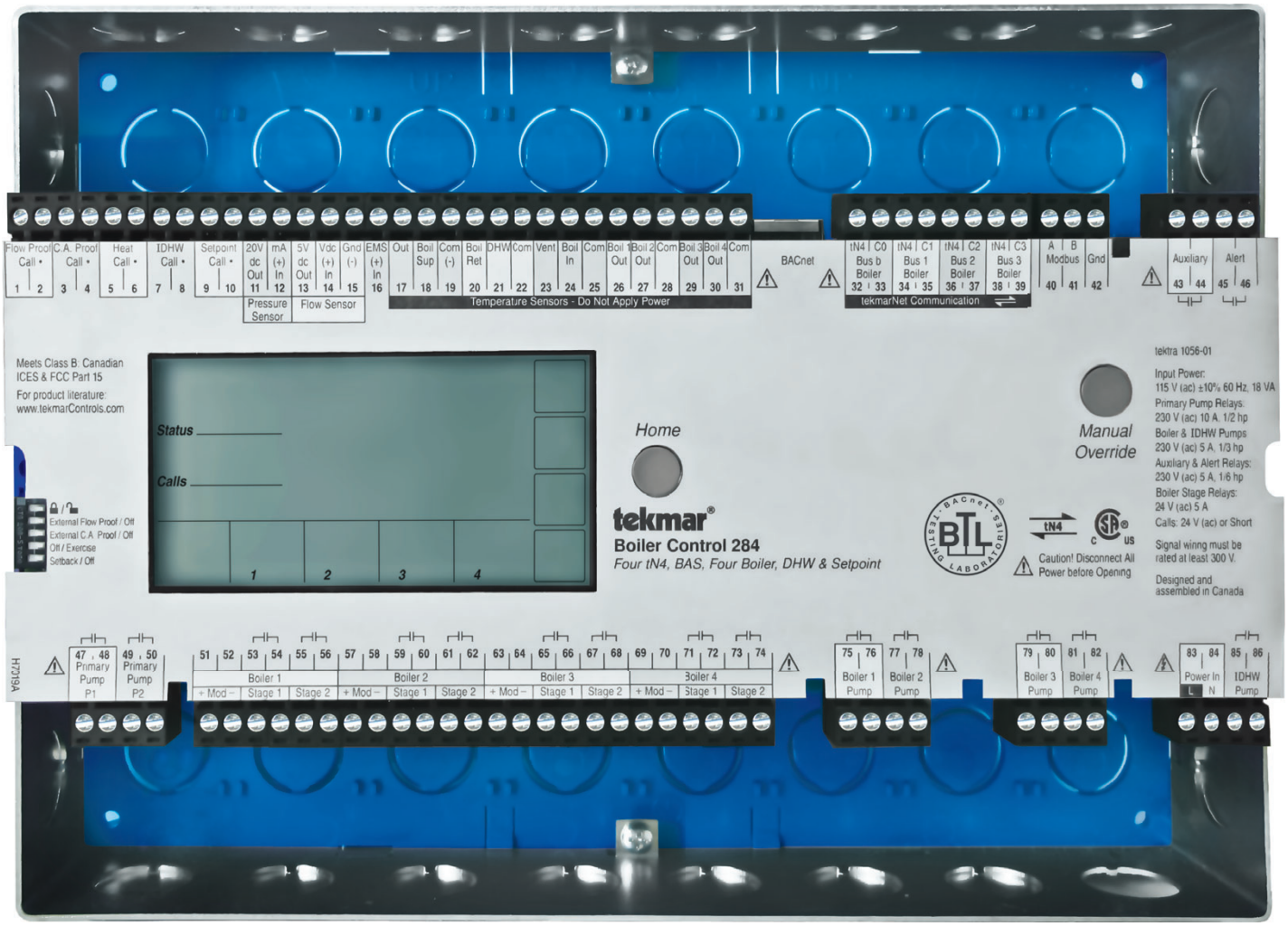
284_A
06/13

Replaces: 02/13

The Boiler Control 284 obtains maximum efficiency from mixed boiler plants by taking the characteristics of each boiler into account along with the target water temperatures & outdoor temperature.

The 284 provides numerous control options beyond the applications featured in this brochure. For a complete list of settings, refer to the 284_D Installation & Operation Manual.

- Outdoor temperature reset
- Programmable schedules
- tekmarNet® 4 compatible
- Control up to four boilers
- Condensing & non-condensing boiler groups
- Modulating, single stage or two stage
- BACnet® IP or Modbus® communication
- Primary pump sequencing
- DHW priority
- Setpoint operation
- Combustion air damper control
- Energy, flow & pressure monitoring



## Description

Two single stage non-condensing boilers & two modulating condensing boilers are operated to provide a boiler target temperature for space heating, indirect DHW and setpoint loads. The boiler target temperature for the space heating load is determined from outdoor temperature reset.

## Features:

- The boiler plant is sequenced to obtain maximum efficiency based on the boiler types & target temperatures. For detailed information about sequencing, rotation & staging, refer to the 284_D Installation & Operation Manual.
- Dual primary pumps with a flow proof provide redundancy. Pumps can be sequenced with equal run-time rotation.
- A flow sensor is used to prove flow for the primary pumps. The flow sensor is also used for energy monitoring.
- System includes a combustion air (C.A.) damper. Proving of C.A. damper via external C.A. proof (motor end switch).
- Boiler ΔT monitoring is available when using optional boiler outlet sensors (S6 to S9) & boiler inlet sensor (S5).
- Remote monitoring from the Internet is available through the tN4 Gateway 483.
- Communication with a Building Automation System (BAS) is available using BACnet® IP or Modbus®.

## Essential Source (#) Settings:

| | |
|---|---|
| ENABLE (1) = AUTO | ENABLE (3) = AUTO |
| CONDENSE (1) = NO | CONDENSE (3) = YES |
| Boil TYPE (1) = 1STG | Boil TYPE (3) = MOD |
| ENABLE (2) = AUTO | ENABLE (4) = AUTO |
| CONDENSE (2) = NO | CONDENSE (4) = YES |
| Boil TYPE (2) = 1STG | Boil TYPE (1) = MOD |

## Essential System Settings:

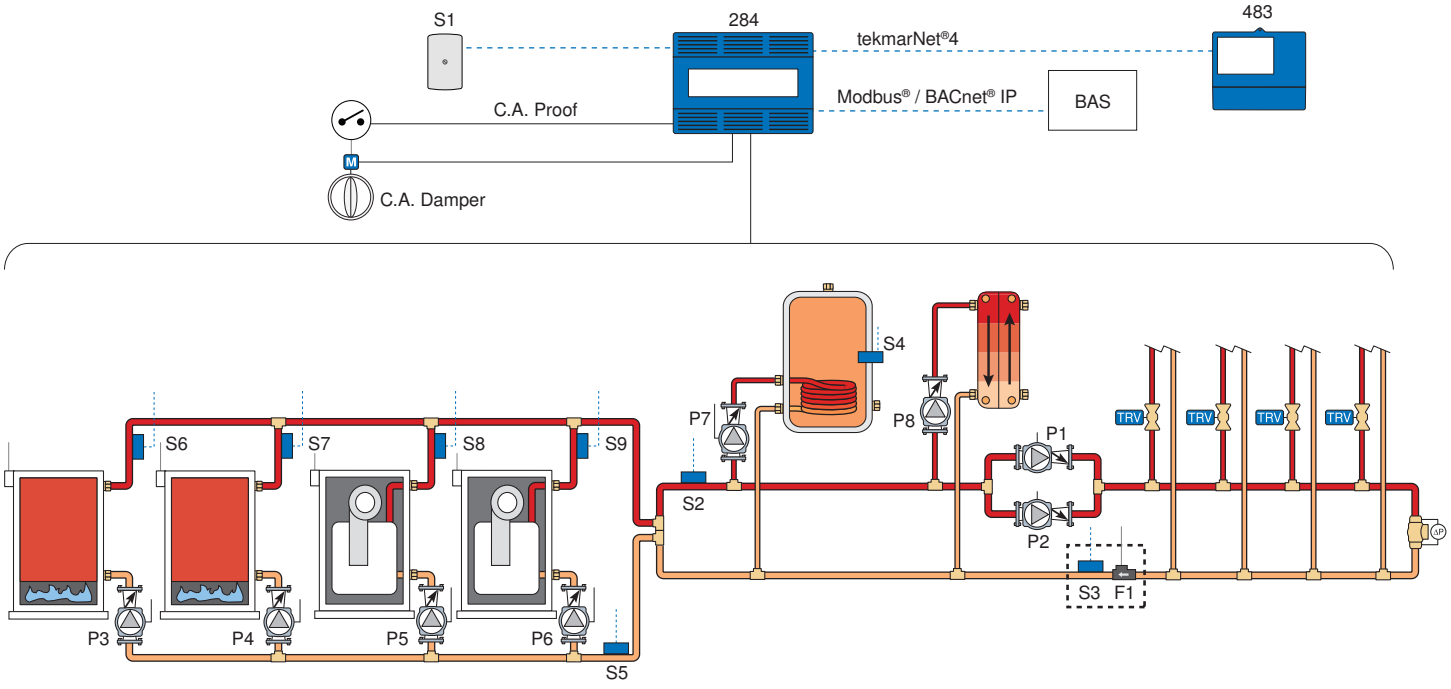
| | |
|---|---|
| APP MODE = RSET | IDHW SENSOR = ON |
| AUX RELAY = DMPR | IDHW PRIM PUMP = OFF |
| PUMP 1 = AUTO | SETP MODE = ON |
| PUMP 2 = AUTO | SETP PRIM PUMP = OFF |
| IDHW MODE = ON | FLOW SENSOR = ON |
| IDHW LOCATION = Boil | FLOW PROOF = 1 to 100% |

## Legend

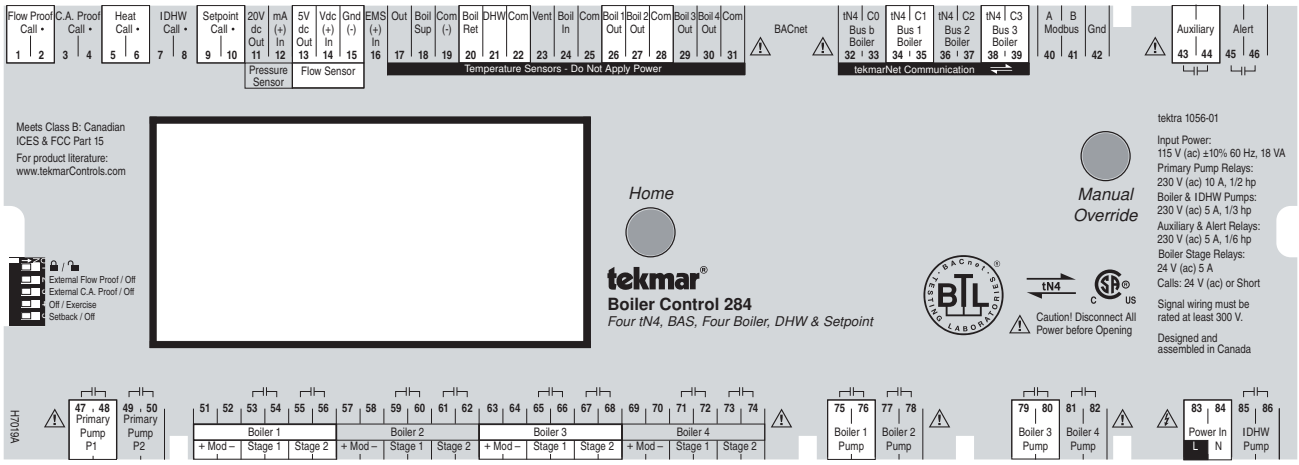
S1 = Outdoor Sensor
S2 = Boiler Supply Sensor
S3 = Boiler Return Sensor
S4 = DHW Sensor
S5 = Boiler Inlet Sensor
S6-S9 = Boiler Outlet Sensors
F1 = Flow Sensor
P1, P2 = Primary Pumps
P3-P6 = Boiler Pumps
P7 = IDHW Pump
P8 = Setpoint Pump

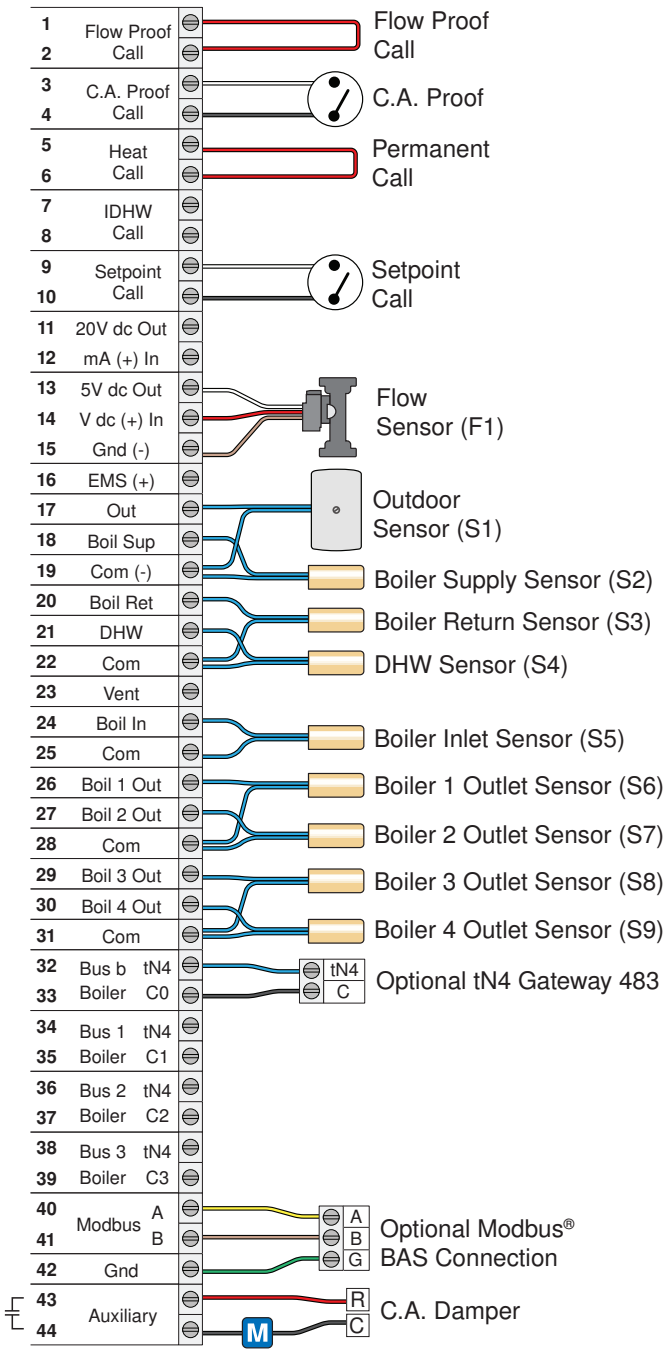
## DIP Settings:

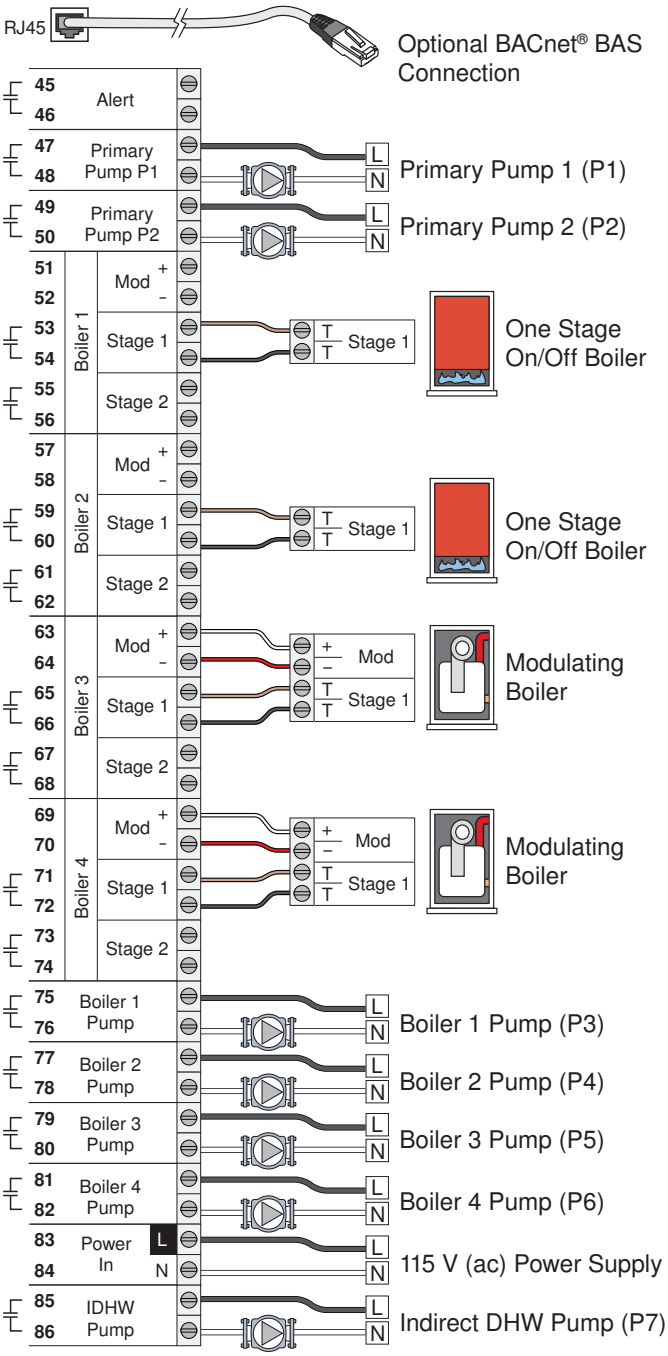
/
External Flow Proof / Off
External C.A. Proof / Off
Off / Exercise
Setback / Off




**Concept Drawing:** This is only a concept drawing, not an engineered drawing. It is not intended to describe a complete system, nor any particular system. It is up to the system designer to determine the necessary components for and configuration of the particular system being designed, including additional equipment, isolation relays (for loads greater than the control's specified output ratings), and any safety devices which in the judgement of the designer are appropriate, in order to properly size, configure and design that system and to ensure compliance with building and safety code requirements.



## Description

Four modulating condensing boilers are operated to provide an outdoor temperature reset boiler target for a space heating load. The fourth boiler also operates to provide heat for an indirect DHW load with priority over space heating.

## Features:

- The boiler plant is sequenced to obtain maximum efficiency based on the boiler types & target temperatures. For detailed information about sequencing, rotation & staging, refer to the 284_D Installation & Operation Manual.
- Dual primary pumps with a flow proof provide redundancy. Pumps can be sequenced with equal run-time rotation.
- Boiler ΔT monitoring is available when using optional boiler outlet sensors (S6 to S9) and boiler inlet sensor (S5).
- The boiler outlet sensor S9 is required for indirect DHW operation.

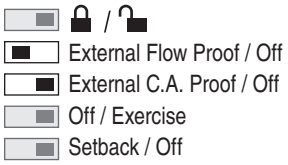
## Essential Source (#) Settings:

ENABLE (1) = AUTO
CONDENSE (1) = YES
Boil TYPE (1) = MOD
ENABLE (2) = AUTO
CONDENSE (2) = YES
Boil TYPE (2) = MOD
ENABLE (3) = AUTO
CONDENSE (3) = YES
Boil TYPE (3) = MOD
ENABLE (4) = AUTO
CONDENSE (4) = YES
Boil TYPE (4) = MOD

## Essential System Settings:

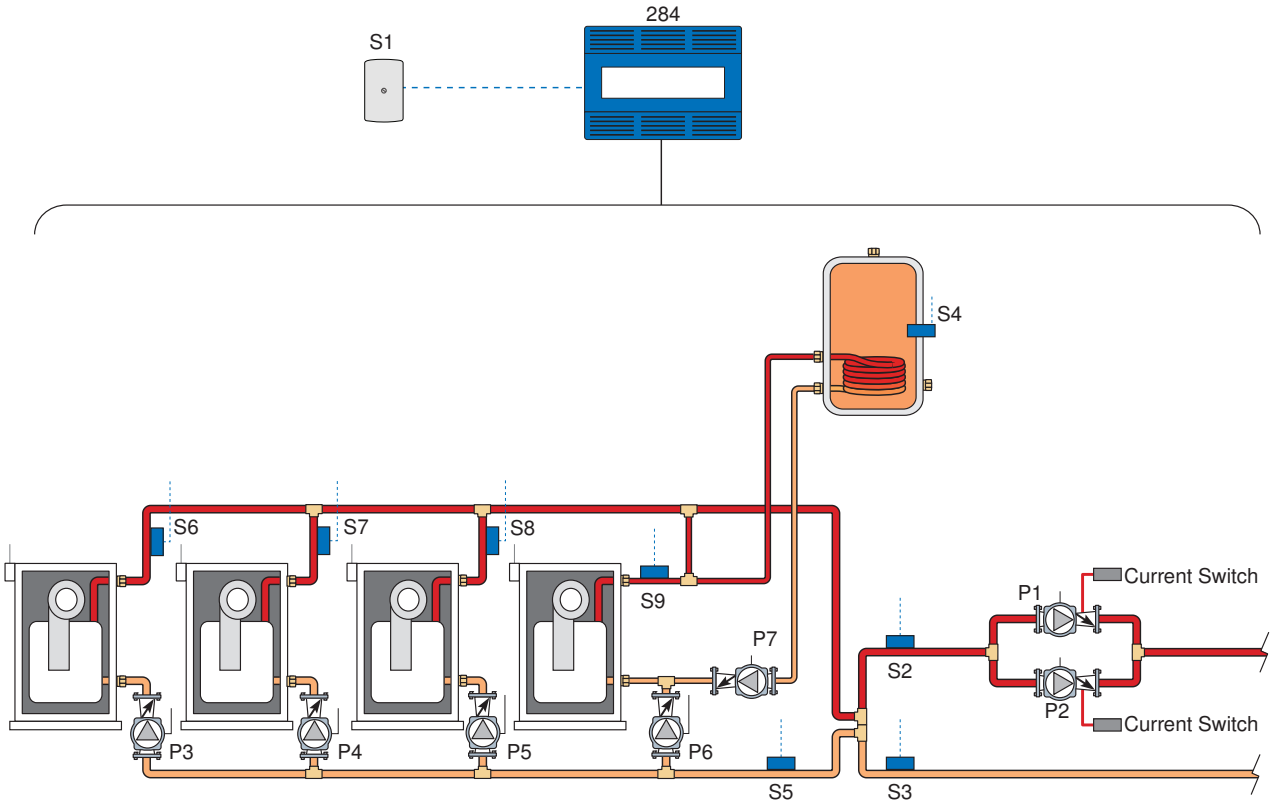
APP MODE = RSET
PUMP 1 = AUTO
PUMP 2 = AUTO
IDHW MODE = ON
IDHW LOCATION = NEAR
IDHW SENSOR = ON

## DIP Settings:




## Legend

S1 = Outdoor Sensor
S2 = Boiler Supply Sensor
S3 = Boiler Return Sensor
S4 = DHW Sensor
S5 = Boiler Inlet Sensor
S6-S9 = Boiler Outlet Sensors
P1, P2 = Primary Pumps
P3-P6 = Boiler Pumps
P7 = IDHW Pump

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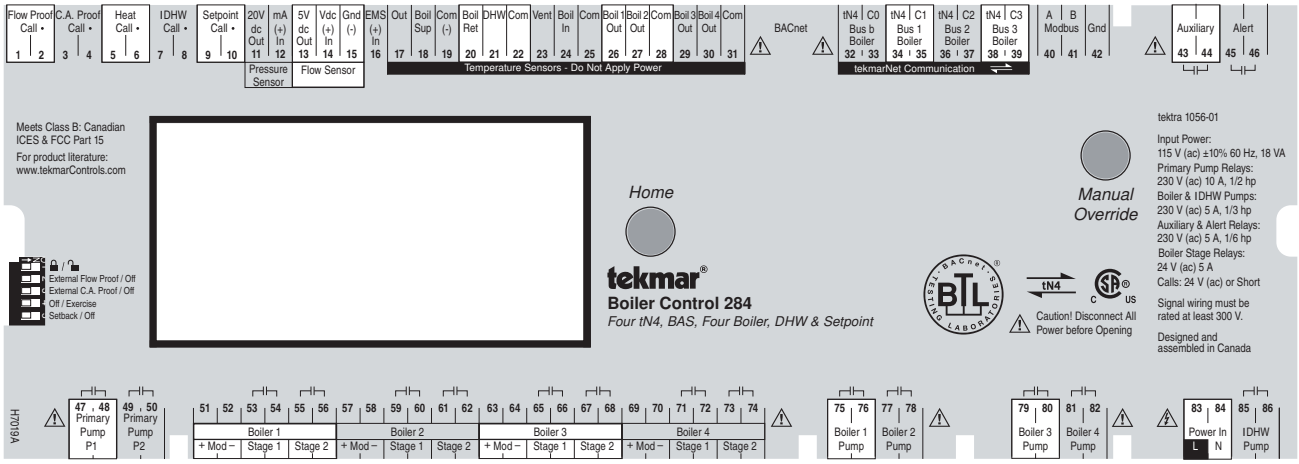
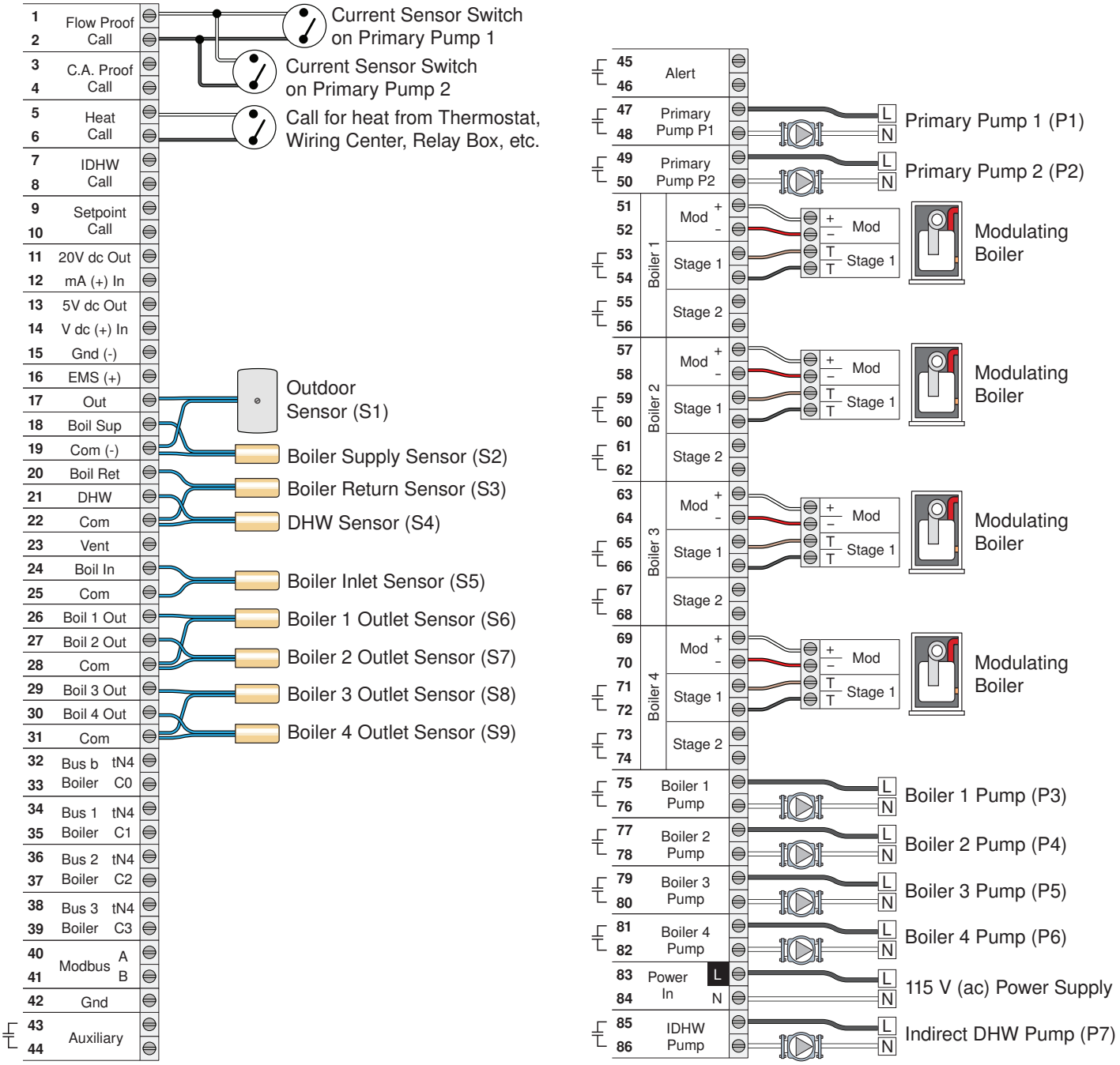


## Description

Four two-stage non-condensing boilers are operated to provide a fixed setpoint temperature for a dedicated DHW load. The DHW recirculation pump can optionally be operated on a schedule to save energy.

## Features:

- The boiler plant is sequenced to obtain maximum efficiency based on the boiler types & target temperatures. For detailed information about sequencing, rotation & staging, refer to the 284_D Installation & Operation Manual.
- Boiler ΔT monitoring is available when using optional boiler outlet sensors (S3 to S6) & boiler inlet sensor (S2).

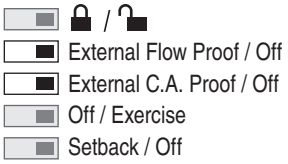
## Essential Source (#) Settings:

| | |
|---|---|
| ENABLE (1) = AUTO | ENABLE (3) = AUTO |
| CONDENSE (1) = NO | CONDENSE (3) = NO |
| Boil TYPE (1) = 2STG | Boil TYPE (3) = 2STG |
| ENABLE (2) = AUTO | ENABLE (4) = AUTO |
| CONDENSE (2) = NO | CONDENSE (4) = NO |
| Boil TYPE (2) = 2STG | Boil TYPE (4) = 2STG |

## Essential System Settings:

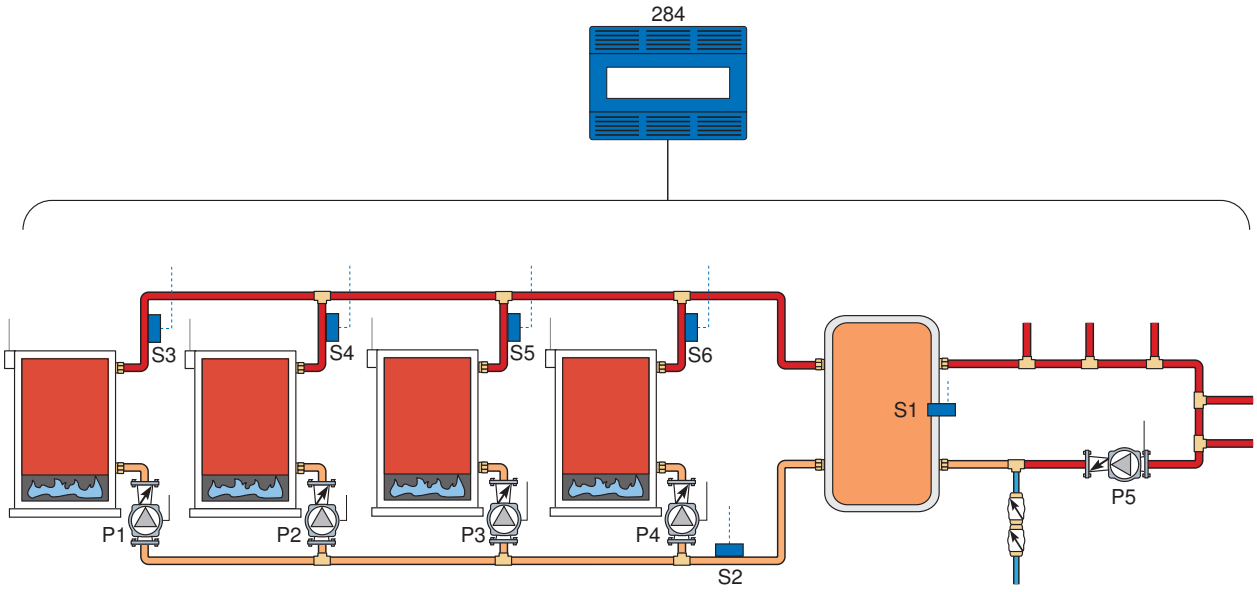
APP MODE = DDHW
AUX RELAY = DHWR

## DIP Settings:




## Legend

S1 = DHW Sensor
S2 = Boiler Inlet Sensor
S3-S6 - Boiler Outlet Sensors
P1-P4 = Boiler Pumps
P5 = DHW Recirculation Pump

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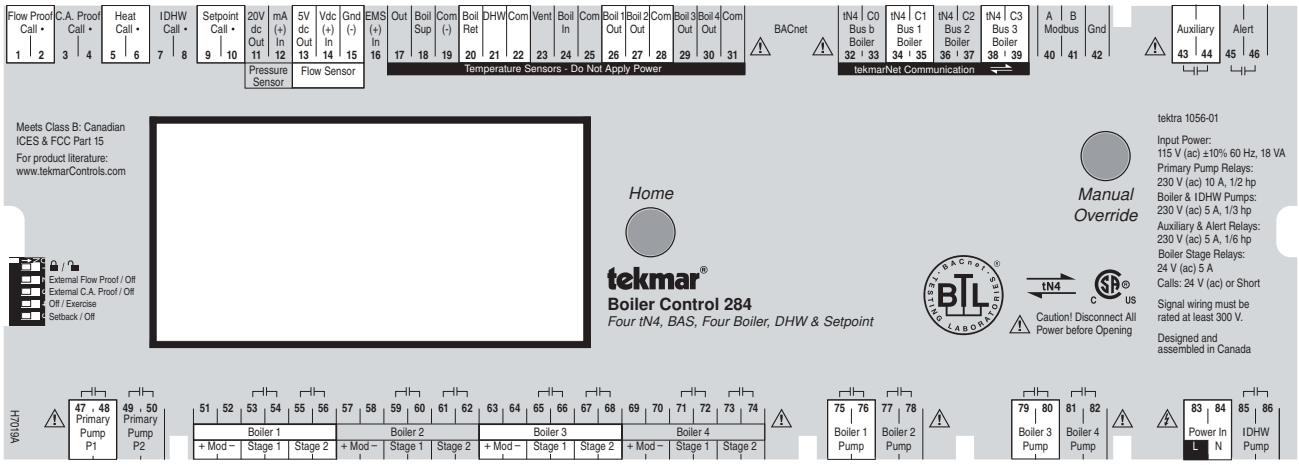
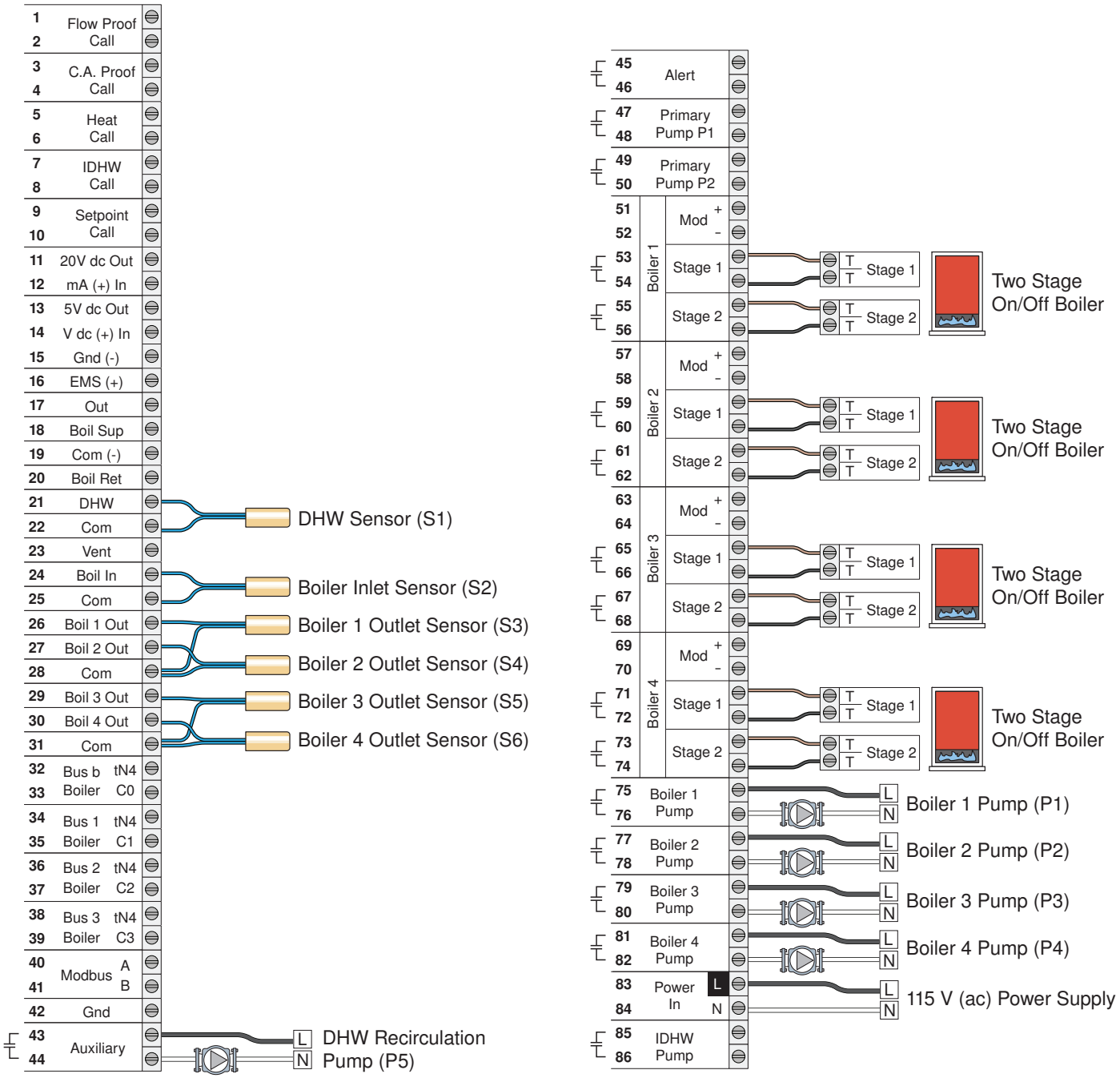


## Description

Two modulating condensing boilers are operated to provide heat for space heating and indirect DHW loads. The boiler target temperature for the space heating load is determined from outdoor temperature reset and indoor temperature feedback provided by tekmarNet® thermostats.

## Features:

- The boiler plant is sequenced to obtain maximum efficiency based on the boiler types & target temperatures. For detailed information about sequencing, rotation & staging, refer to the 284_D Installation & Operation Manual.
- Outdoor Temperature Reset saves energy by operating the boiler plant using the lowest possible temperatures. Lower water temperatures ensure modulating condensing boilers operate at maximum efficiency.
- Indoor Temperature Feedback compensates for heat loss or gain caused by the sun, appliances or occupant activity to improve system efficiency, comfort & response time.
- Optional indirect DHW (IDHW) priority.
- Boiler ΔT monitoring is available when using optional boiler outlet sensors (S6 & S7) and boiler inlet sensor (S5).
- Remote access options are available through the tN4 Gateway 482 or 483.
- The sensor required to support vent temperature sensing (S8) is scheduled for a future release.

## Essential Source (#) Settings:

| | |
|---|---|
| ENABLE (1) = AUTO | CONDENSE (2) = YES |
| CONDENSE (1) = YES | Boil TYPE (2) = MOD |
| Boil TYPE (1) = MOD | ENABLE (3) = OFF |
| ENABLE (2) = AUTO | ENABLE (4) = OFF |

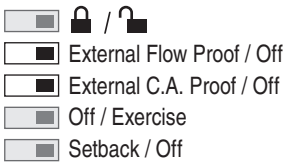
## Essential System Settings:

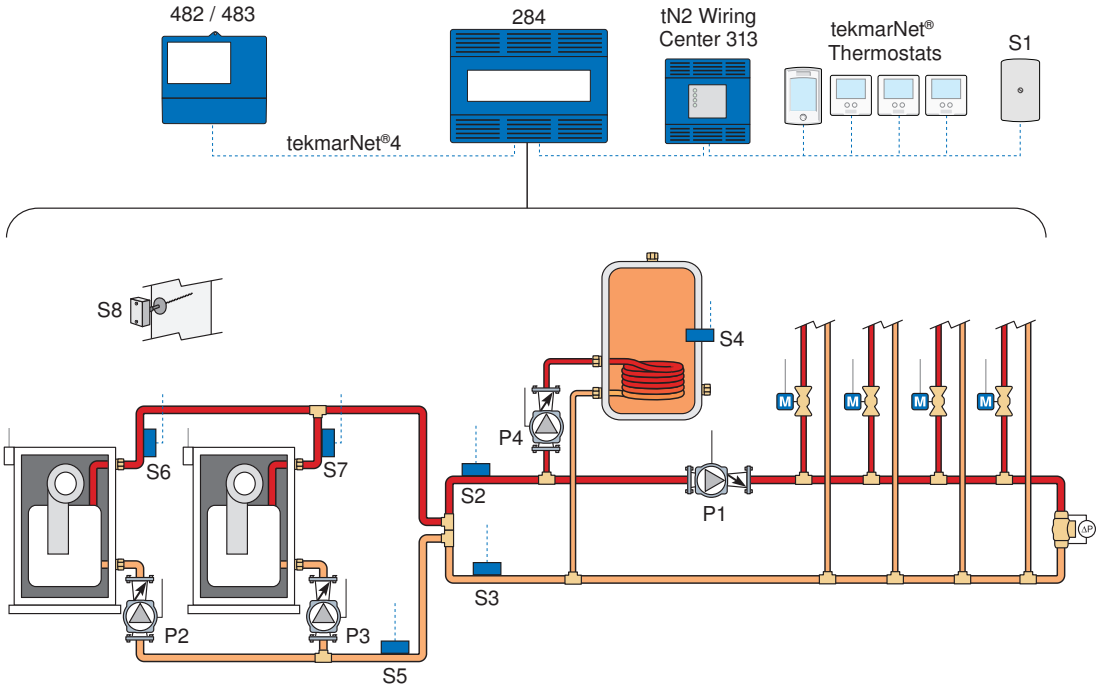
| | |
|---|---|
| APP MODE = RSET | IDHW LOCATION = Boil |
| PUMP 1 = AUTO | IDHW SENSOR = ON |
| PUMP 2 = OFF | IDHW PRIM PUMP = OFF |
| IDHW MODE = ON | |

## Legend

| | | |
|---|---|---|
| S1 = Outdoor Sensor | S5 = Boiler Inlet Sensor | P2, P3 = Boiler Pumps |
| S2 = Boiler Supply Sensor | S6, S7 = Boiler Outlet Sensors | P4 = IDHW Pump |
| S3 = Boiler Return Sensor | S8 = Vent Sensor | |
| S4 = DHW Sensor | P1 = Primary Pump | |

## DIP Settings:

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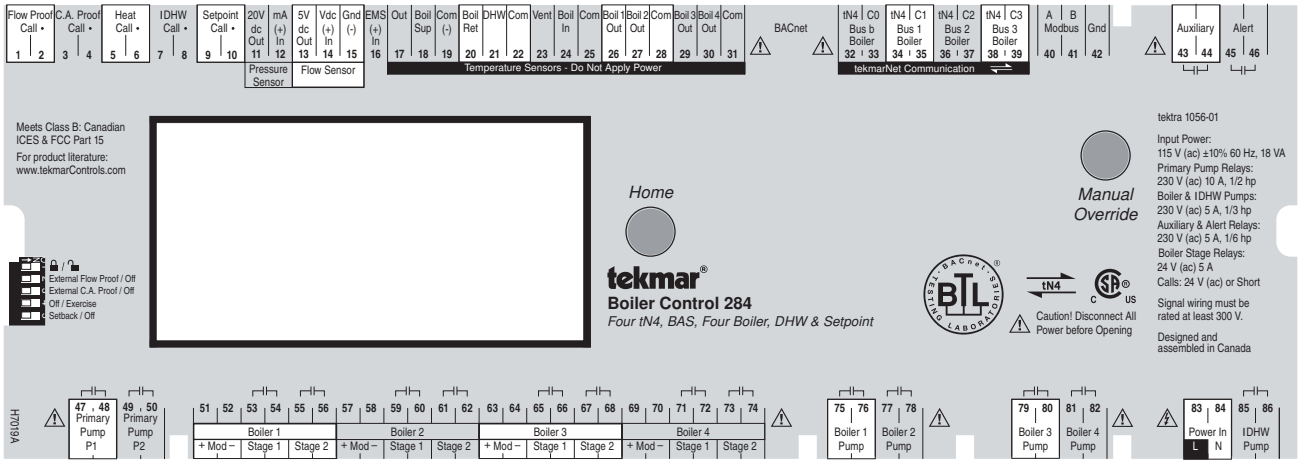
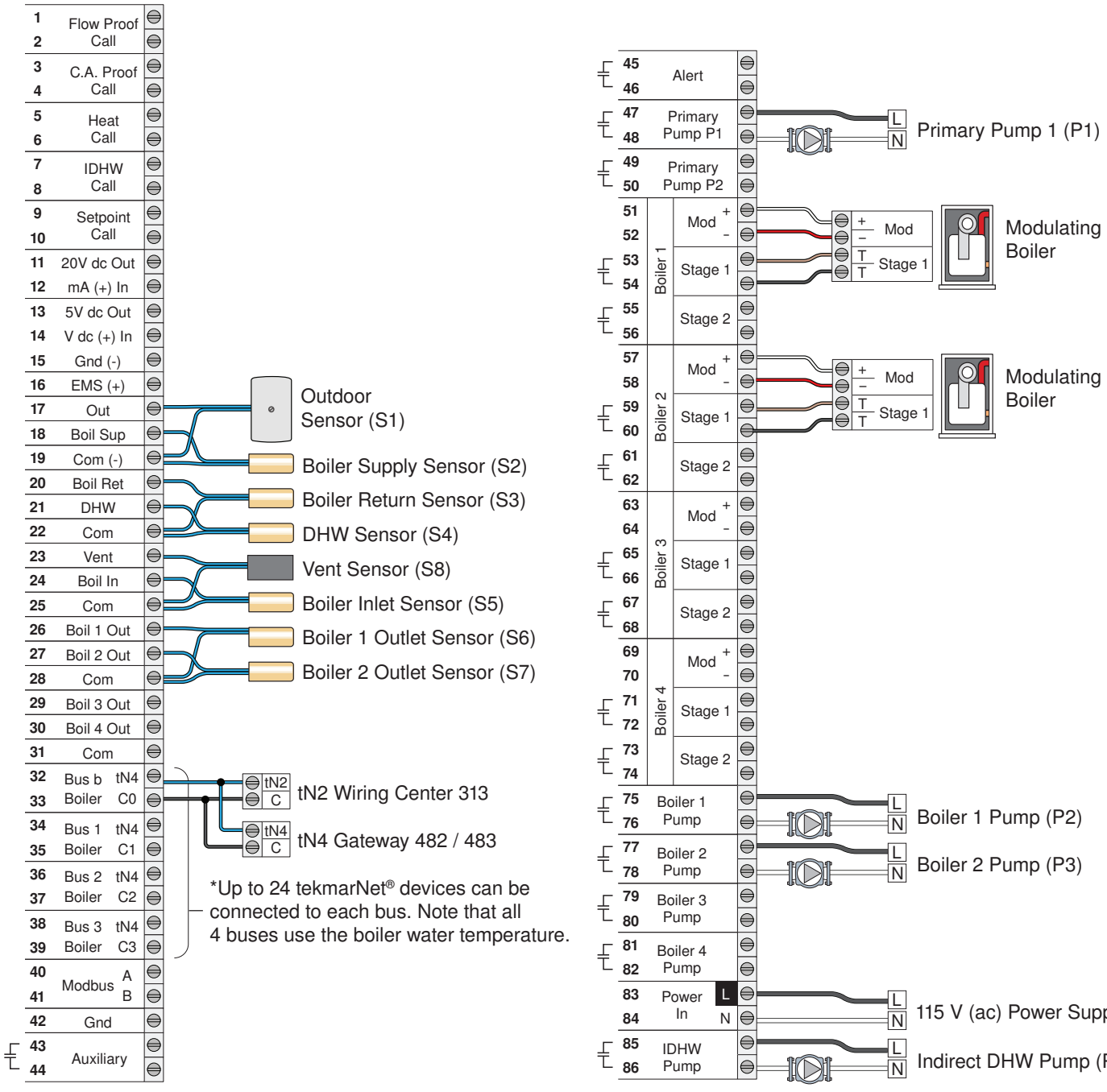


## Description

Two modulating non-condensing boilers are operated to provide a boiler target temperature for space heating and indirect DHW loads. The boiler target temperature for the space heating load is determined from outdoor temperature reset and indoor temperature.

## Features:

- The boiler plant is sequenced to obtain maximum efficiency based on the boiler types & target temperatures. For detailed information about sequencing, rotation & staging, refer to the 284_D Installation & Operation Manual.
- Dual primary pumps with a flow proof provide redundancy. Pumps can be sequenced with equal run-time rotation. A pressure differential switch is used to prove primary pump flow.
- System includes combustion air (C.A.) damper. Proving of C.A. damper via external C.A. proof (motor end switch).
- A flow sensor and pressure sensor are used for monitoring flow, energy and gauge pressure.
- Boiler ΔT monitoring is available when using optional boiler outlet sensors (S6 & S7) & boiler inlet sensor (S5).
- Remote access options are available through the tN4 Gateway 482 or 483.

## Essential Source (#) Settings:

ENABLE (1) = AUTO
CONDENSE (1) = NO
Boil TYPE (1) = MOD
ENABLE (2) = AUTO
CONDENSE (2) = NO
Boil TYPE (2) = MOD
ENABLE (3) = OFF
ENABLE (4) = OFF

## Essential System Settings:

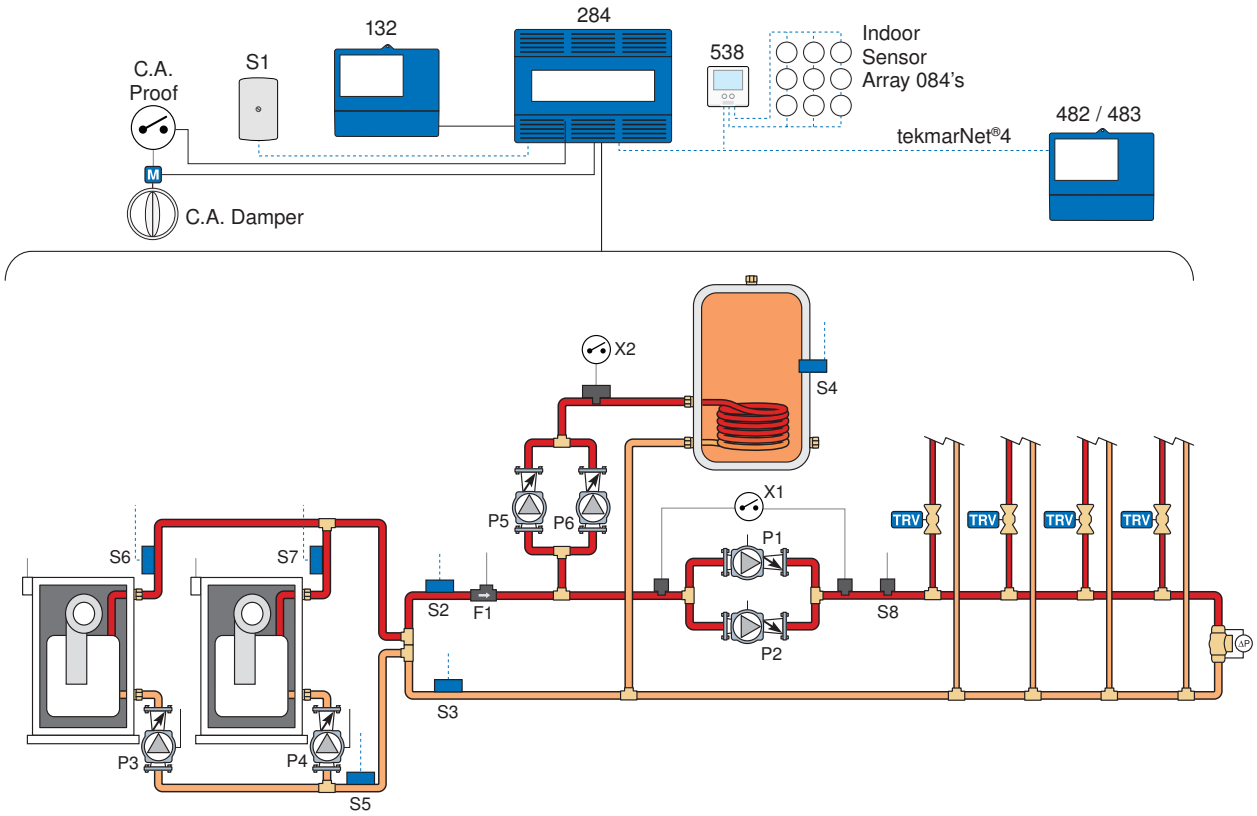
APP MODE = RSET
AUX RELAY = DMPR
PUMP 1 = AUTO
PUMP 2 = AUTO
IDHW MODE = ON
IDHW LOCATION = Boil
IDHW SENSOR = ON
IDHW PRIM PUMP = OFF
FLOW SENSOR = ON
PRES SENSOR = ON

## Legend

S1 = Outdoor Sensor
S2 = Boiler Supply Sensor
S3 = Boiler Return Sensor
S4 = DHW Sensor
S5 = Boiler Inlet Sensor
S6, S7 = Boiler Outlet Sensors
S8 = Pressure Sensor
P1, P2 = Primary Pumps
P3, P4 = Boiler Pumps
P5, P6 = IDHW Pump
X1 = Pressure Differential Switch
X2 = Flow Switch
(connected to 132)

## DIP Settings:

/
External Flow Proof / Off
External C.A. Proof / Off
Off / Exercise
Setback / Off

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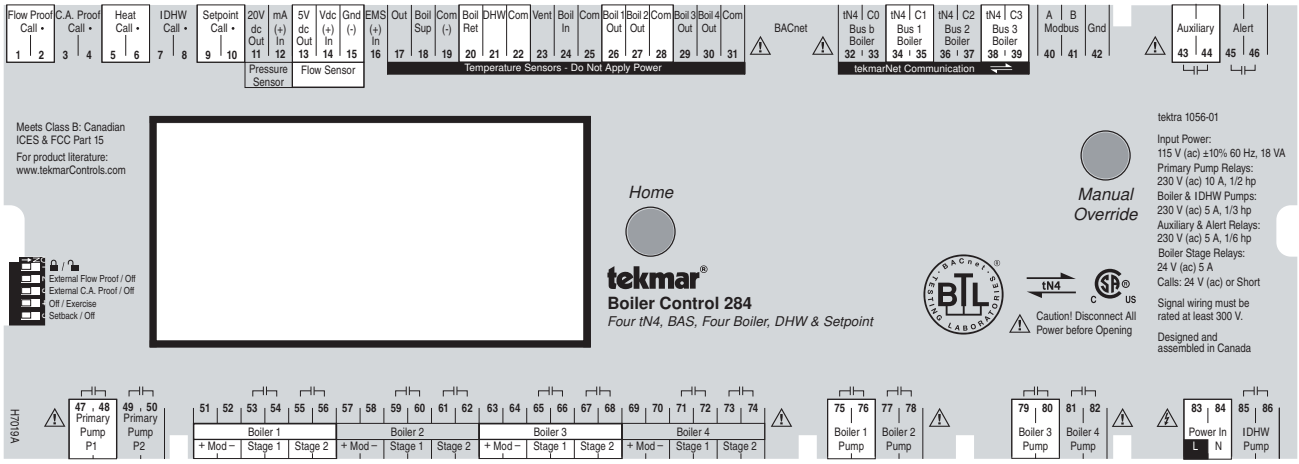


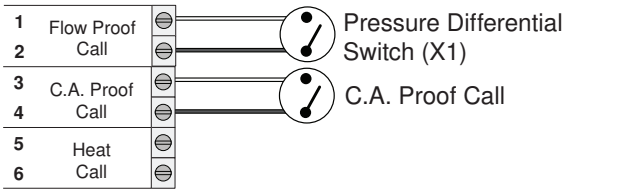


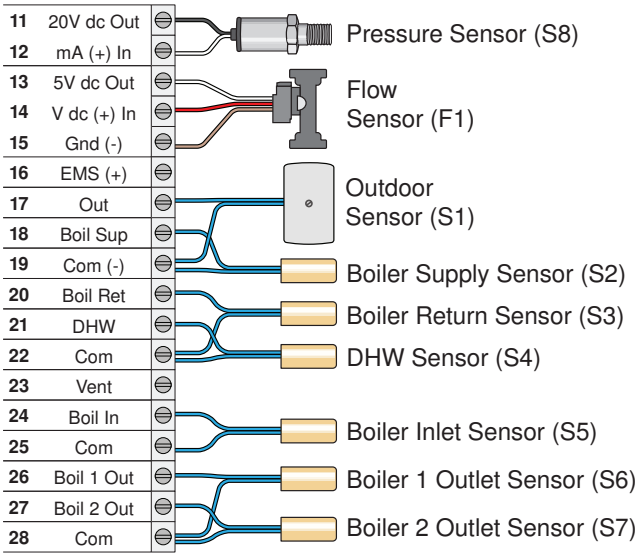


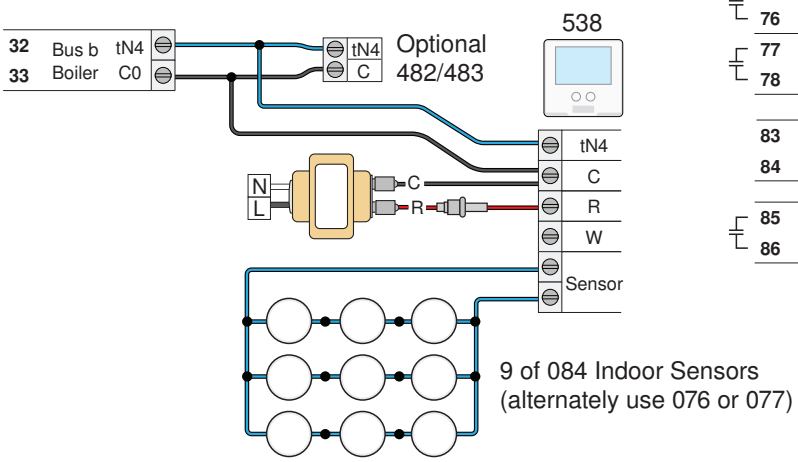


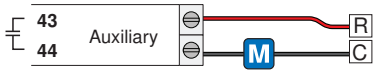


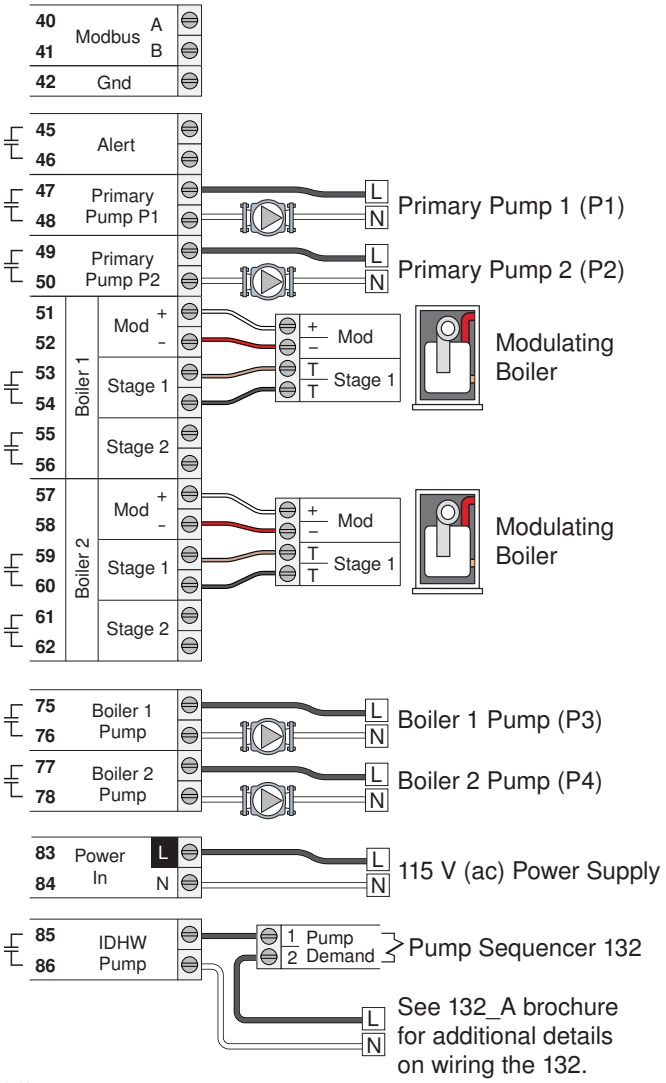

## Specifications

**The following are the recommended specifications for the Boiler Control 284**

- The control shall be capable of sequencing up to four single stage, two stage or modulating boilers.
- The control shall be capable of operating combinations of condensing & non-condensing boilers.
- The control shall be capable of adjusting the boiler plant target to provide indirect domestic hot water heating with priority.
- The control shall have the ability to calculate the boiler plant target temperature based on outdoor temperature reset.
- The control shall have the ability to set the boiler plant target temperature using an adjustable setpoint.
- The control shall have the ability to set the boiler plant target temperature as directed by a BAS, BMS or EMS.
- The control shall have an adjustable warm weather shut down applied to outdoor temperature reset operation.
- The control shall be able to operate two primary pumps in standby mode.
- The control shall have the options of a proof demand input or a flow sensor input to prove flow for the primary pump.
- The control shall provide an alert output for flow proof, CA proof & no heat failures.
- The control shall be able to operate one primary pump & one domestic hot water pump during a domestic hot water call.
- The control shall communicate with Modbus®, BACnet® IP & tekmarNet® systems to provide remote monitoring & adjustment.
- The control shall have the ability to display the current temperature difference between the return temperature & the supply temperature, ΔT.
- The control shall have the option to measure fluid pressure & flow rates.
- The control shall have an option to rotate the boilers & primary pumps based on the accumulated running hours.
- The control shall display the run time of the boilers & optionally, primary pumps.
- The control shall use proportional, integral & derivative (PID) logic when modulating the boilers.
- The control shall have the option to modulate the boilers sequentially or in parallel.
- The control shall have an adjustable minimum supply water temperature setting to help prevent condensation of flue gases & subsequent corrosion & blockage of the boiler's heat exchanger & chimney.
- The control shall have the option of an automatic differential calculation in order to prevent short cycling of the boilers.
- The control shall have the ability to operate individual boiler pumps.
- The control shall have adjustable post purge settings that allow the primary & boiler pumps to run for a set period after the boiler has been shut off.
- The control shall have the option for fixed lead & fixed last boiler rotation.
- The control shall have the option to prove & operate a combustion air damper output.
- The control shall have an adjustable minimum inter-stage delay that can be set manually or calculated by the control.
- The control shall have the option of accepting a 0 – 10 V (dc) or 2 – 10 V (dc) input signal from an energy management system with an adjustable offset.
- The control shall have three separate lockable access levels (Advanced, Installer, User) to limit the number of setting adjustments available to various users.
- The control shall have manual override options to test boiler & pump operation, suspend boiler plant operation, operate pumps for purging & operate the system with a maximum heat output.
- The control shall have the ability to display the current outdoor, boiler supply, outlet, return & inlet temperatures.
- The control shall continually monitor the temperature sensors & provide an error message upon a control or sensor failure.
- During extended periods of inactivity, all pumps shall be periodically exercised to prevent seizure during long idle periods.
- The control shall include a setback schedule that can be used by the control itself or shared with other tN4 devices.
- The control shall have the option to operate as a tN4 system control with a tN4 boiler bus.
- The control shall display the current % modulation of each boiler, or the number of stages fired.
- The control shall include an adjustment for the cycle length if connected to a tN4 network.

tekmar® Control Systems

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