April 1994

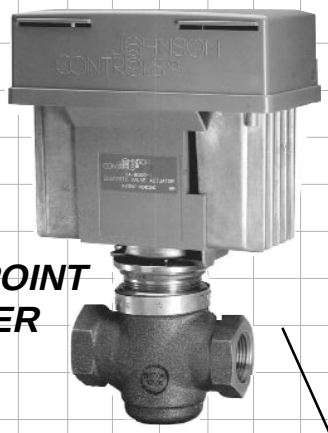
Kele™

UCM-420A

Setpoint Controller

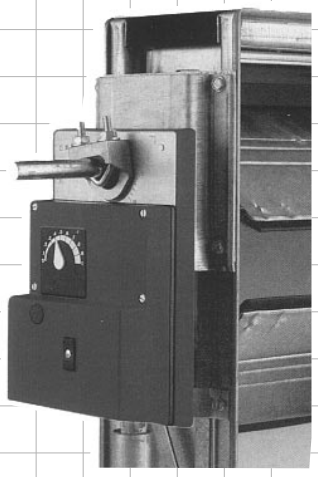
Operating and Installation Instructions

A LARGE number of applications in a SMALL package...



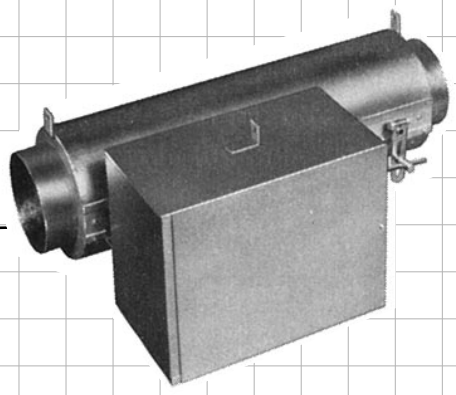
REMOTE SETPOINT CONTROLLER

LOCAL SETPOINT CONTROLLER

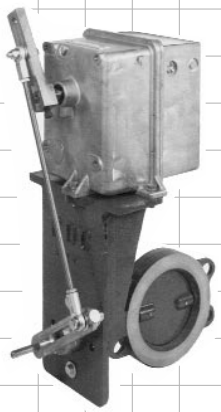


4-20 mA SIGNAL GENERATOR

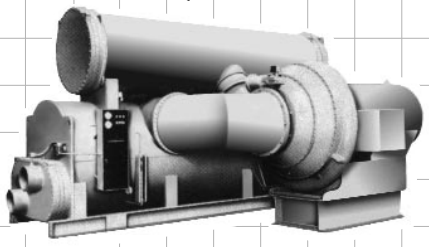
UCM-420A



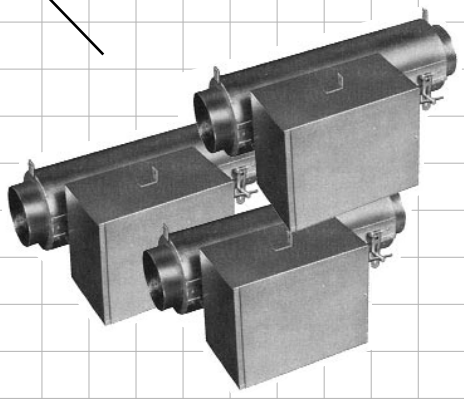
REMOTE SETPOINT CONTROLLER WITH LOCAL ADJUSTMENT



PULSE-WIDTH TO ANALOG CONVERTER



SAMPLE AND HOLD



OUTPUT EXPANDER

About the UCM-420A

The **UCM-420A** is a low-cost microprocessor-based controller that uses industry-standard 4-20 mA or 1-5 VDC input/output signals to provide stand-alone P/I control or output expansion.

When used as a **Stand-Alone Controller with Local Setpoint**, the **UCM-420A** provides proportional/integral control of VFDs, valves, actuators, or any device that accepts a 4-20 mA or 1-5 VDC signal. Input may be 4-20 mA, 1-5 VDC, or **PreCon Type 3 Thermistor**.

When used as a **Stand-Alone Controller with Remote Setpoint** for P/I control, the setpoints may be adjusted by a 1-5 VDC, 4-20 mA, or pulse-width modulated signal.

When used as a **Remote Setpoint Controller with Local Adjustment**, the remote setpoint can have 100% control, or can establish a base setpoint with the local setpoint having a ±12.5% adjustment.

When used as an **Output Expander**, one AC or DC time-based PWM signal can control up to eight groups of **UCM-420As** independently. This produces eight analog outputs from one PWM controller output. Five common jumper-selectable time bases are available.

Table of Contents

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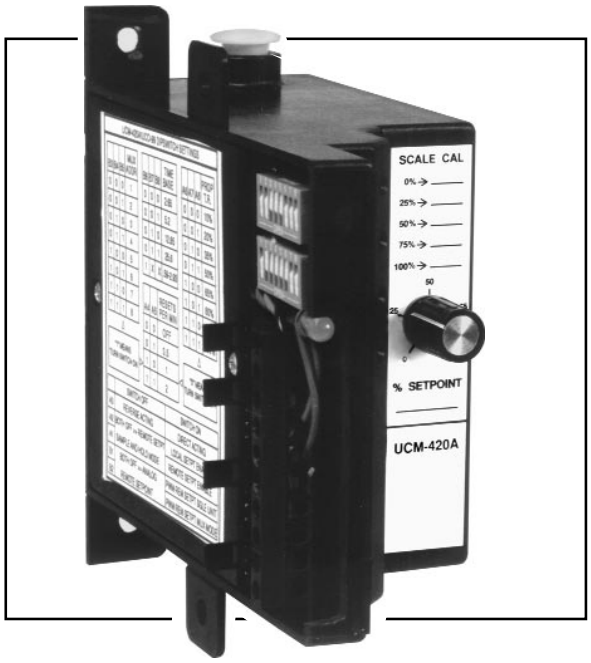
How to Use This Manual

The **UCM-420A** is a very versatile product designed to cover a wide variety of control applications. To properly apply the **UCM-420A**, refer to the **MODES OF OPERATION** (beginning on **page 8**) and select the configuration you desire for your control system. Then proceed to the section and page number indicated for the proper application, wiring and set-up of the **UCM-420A**.



FEATURES

- ***Proportional / Integral Control***
- ***DIP switch / Jumper Programming***
- ***Sample and Hold for Failsafe***
- ***6-Hour Memory on Loss of Power***
- ***Selectable Throttling Range***
- ***Selectable Reset Rates***
- ***Selectable Direct- or Reverse-Acting***
- ***4-20 mA or 1-5 VDC* Output***
- ***4-20 mA, 1-5 VDC or Thermistor Input***

* Requires external 250 ohm resistor

- ***Selectable Pulse-Width Time Base***
- ***Status LED Indication***
- ***Multiplex Input Operation***
- ***Pulse-Width to 4-20 mA Converter***
- ***Remote and/or Local Setpoint***
- ***Local Setpoint Potentiometer Mounted on Unit (Standard)***
- ***Optional DIN Rail Mount***
- ***Optional Setpoint Potentiometer on Stainless Steel Plate***

SPECIFICATIONS

Supply voltage	24 VAC ±10% @ 100 mA (130 mA if PWM input is used) or 24 VDC ±10% @ 50 mA (65 mA if PWM input is used)
Remote setpoint input	4-20 mA, 1-5 VDC, PWM or Multiplexed PWM
Local setpoint input	4-20 mA, 1-5 VDC, three-wire potentiometer or **PreCon** two-wire potentiometer
PWM time base	0.1-2.65, 5.2, 12.85, 25.6 seconds or 0.59-2.93 seconds
Output	4-20 mA sourcing (1-5 VDC with 250 ohm resistor)
Output resolution	256 steps
Output burden	650 ohm maximum
Input	4-20 mA, 1-5 VDC or **PreCon** Type 3 Thermistor (thermistor range 50° to 90°F)*
Input impedance	250 ohms (mA)/10,000 ohms (voltage)
Accuracy	±1%
Operating temperature	32° to 158°F (0° to 70°C)
Humidity limit	95% noncondensing

** Other ranges available*

Installation and Dimensions

INSTALLATION

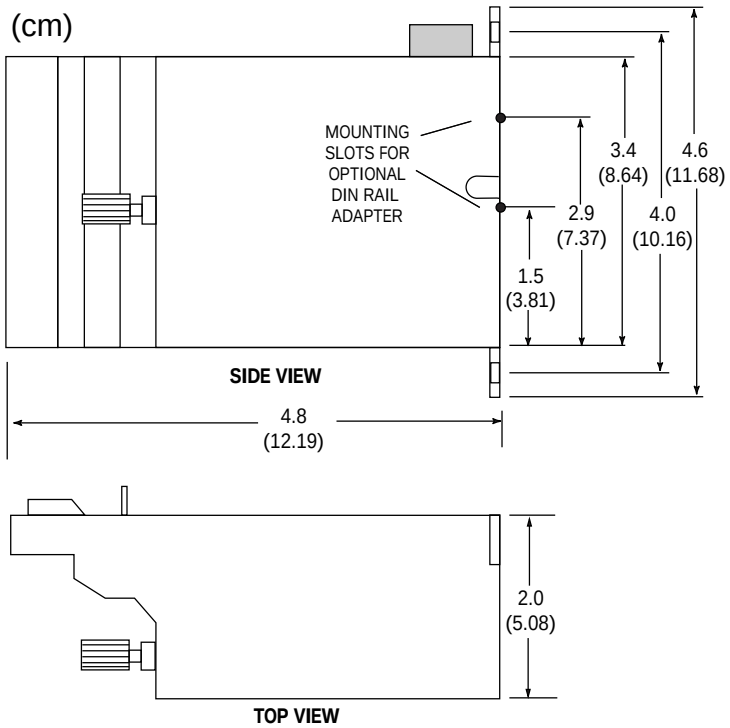
Mount the UCM-420A using the mounting tabs on the unit. If purchased with the UCO-47 DIN Rail Mounting Option, mount on a DIN rail. The UCM-420A must be installed in a clean, dry location, avoiding areas of temperature extremes, corrosive vapors, or electromagnetic interference.

Failure to follow these directions could result in damage to the UCM-420A or other connected equipment, as well as affect the manufacturer's warranty.

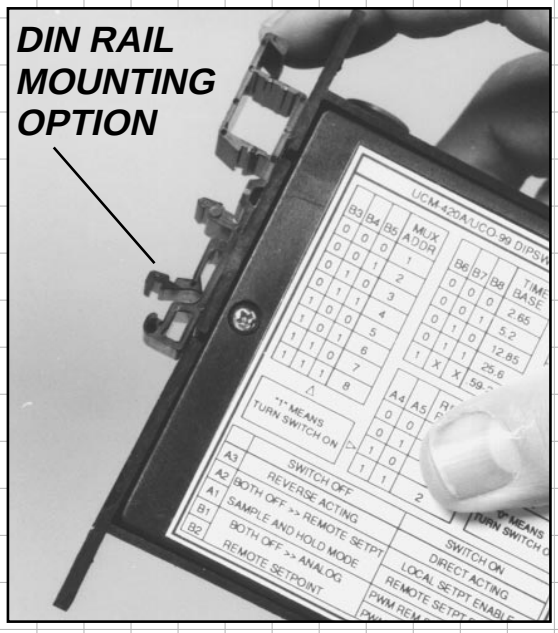
MOUNTING TABS

DIMENSIONS

in
(cm)



DIN RAIL MOUNTING OPTION



General Wiring Instructions & Diagrams

Make all connections according to wiring diagrams and in compliance with national and local codes. Make all connections with power removed. Failure to do so may result in circuit board damage. Shielded cable is recommended for input and analog setpoint wiring. The shield should be connected to the **UCM-420A** "common" terminal. At the opposite end, the shield is not to be connected, and should be taped back. In cases where more wires are required to be connected to the common terminal block of the **UCM-420A** than will fit under the screw on the terminal block, connect as follows:

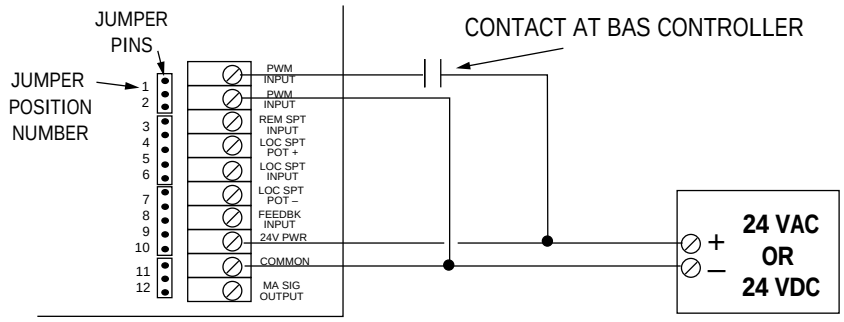
A. Place the 24 VDC minus power wire directly under the "common" screw.
B. Place one or two short splice wires directly under the "common" screw and tighten screw.
C. Make all required "common" connections to the splice wires using crimp connections or wire nuts.

Make all wiring connections for local and/or remote setpoint, input, power, and outputs per the **General Wiring Diagrams** which follow.

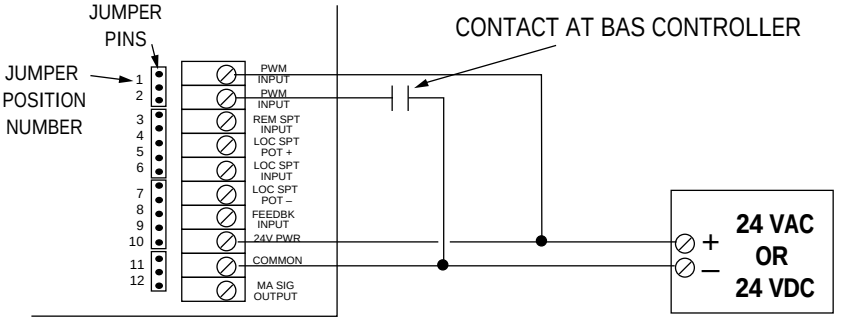
REMOTE SETPOINT WIRING - PULSE-WIDTH SETPOINT (DIAGRAMS 1, 2 & 3)

The PWM Remote Setpoint Signal may be powered by the **UCM-420A** power supply or by a separate power source. If a separate power source is used, the PWM signal may be 24 VAC or 24 VDC. There is no polarity on the PWM terminals. Either leg of the PWM signal may be switched by the controller.
(See General Wiring Diagrams 1, 2 & 3.)

GENERAL WIRING DIAGRAM 1 - **Using the UCM-420A power supply for PWM pulse and switching positive leg of the PWM pulse circuit.**

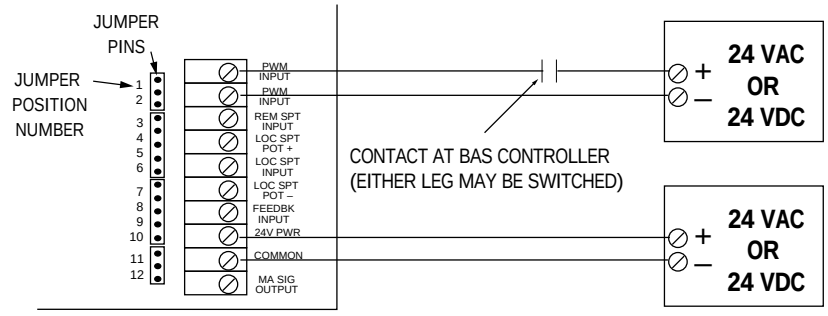


GENERAL WIRING DIAGRAM 2 - **Using the UCM-420A power supply for PWM pulse and switching negative leg of the PWM pulse circuit.**



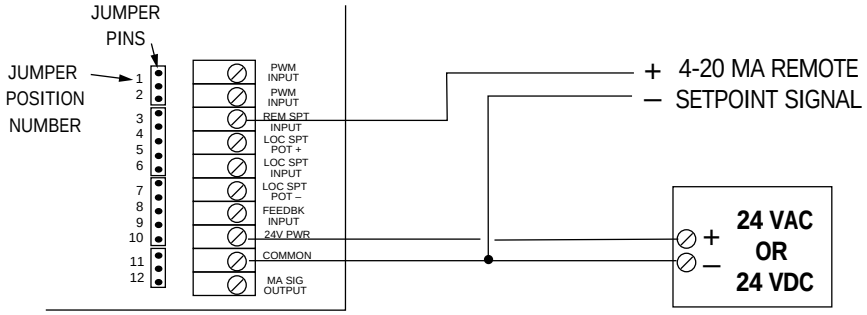
General Wiring Diagrams (Cont.)

GENERAL WIRING DIAGRAM 3 - Completely separate PWM and UCM-420A circuits.

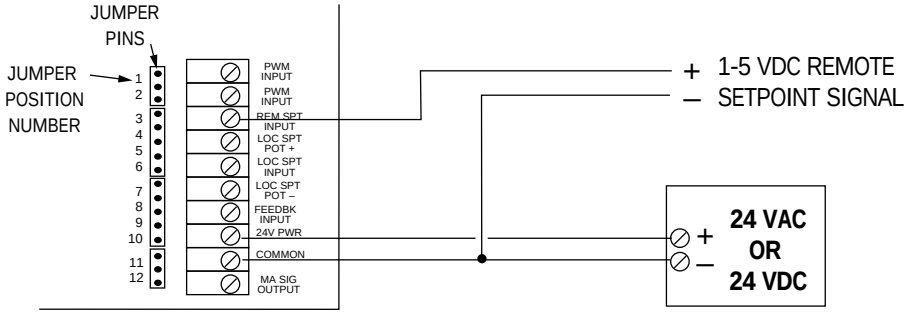


REMOTE SETPOINT - ANALOG SETPOINT WIRING (DIAGRAMS 4 & 5)

GENERAL WIRING DIAGRAM 4 - 4-20 mA remote setpoint



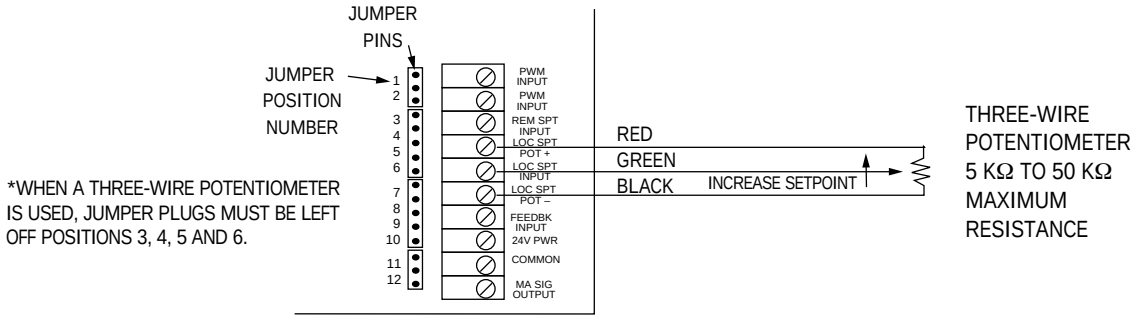
GENERAL WIRING DIAGRAM 5 - 1-5 VDC remote setpoint



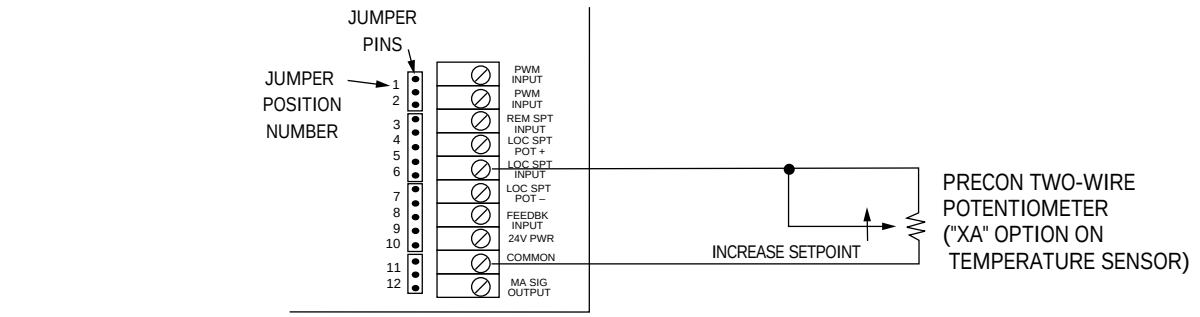
General Wiring Diagrams (Cont.)

LOCAL SETPOINT WIRING (DIAGRAMS 6-9)

GENERAL WIRING DIAGRAM 6 - **Using a three-wire potentiometer for local setpoint. (The UCM-420A is shipped with a three-wire potentiometer mounted and wired per this diagram.)**

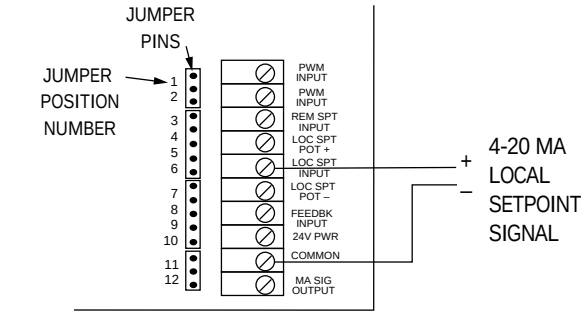


GENERAL WIRING DIAGRAM 7 - **Using a PreCon two-wire potentiometer ("XA" option on a temperature sensor) for local setpoint.**

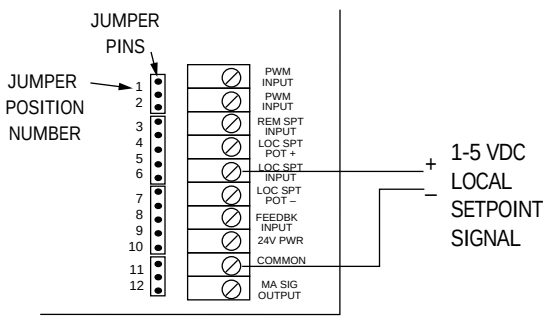


GENERAL WIRING DIAGRAMS 8 & 9 - Using an analog (4-20 mA or 1-5 VDC) signal for local setpoint. Analog signals are normally used as remote setpoints. However, the **UCM-420A** may be configured to accept an analog signal for a local setpoint if this is required.

GENERAL WIRING DIAGRAM 8 - 4-20 mA local setpoint



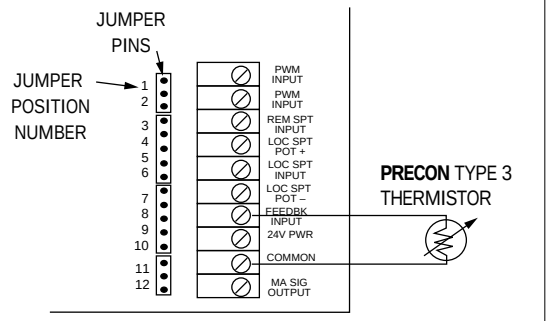
GENERAL WIRING DIAGRAM 9 - 1-5 VDC local setpoint



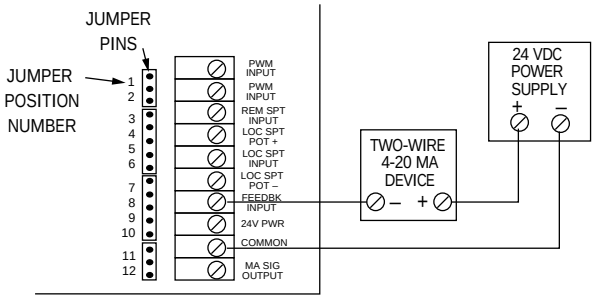
General Wiring Diagrams (Cont.)

INPUT WIRING (DIAGRAMS 10-12)

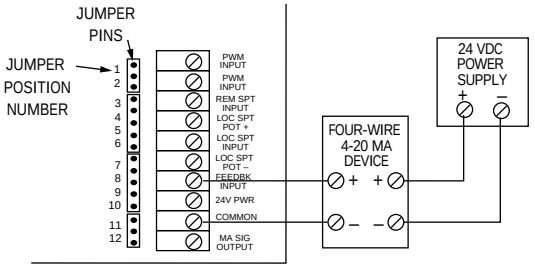
GENERAL WIRING DIAGRAM 10 - PreCon Type 3 Thermistor input



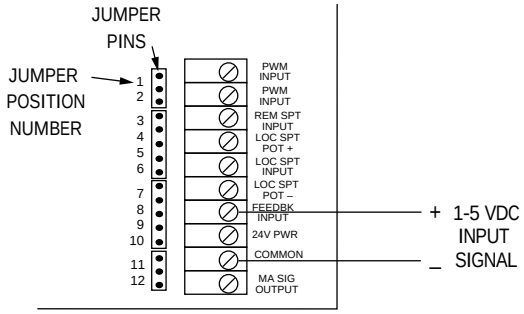
GENERAL WIRING DIAGRAM 11A - 4-20 mA input from a two-wire device



GENERAL WIRING DIAGRAM 11B - 4-20 mA input from a four-wire device

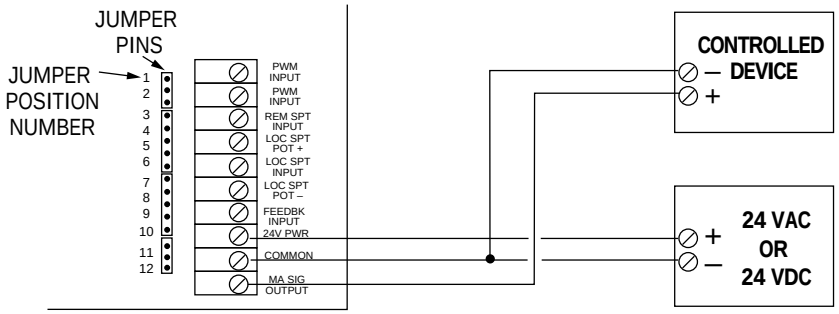


GENERAL WIRING DIAGRAM 12 - 1-5 VDC input signal



POWER SUPPLY & OUTPUT WIRING (DIAGRAM 13)

GENERAL WIRING DIAGRAM 13 - Power supply and output wiring



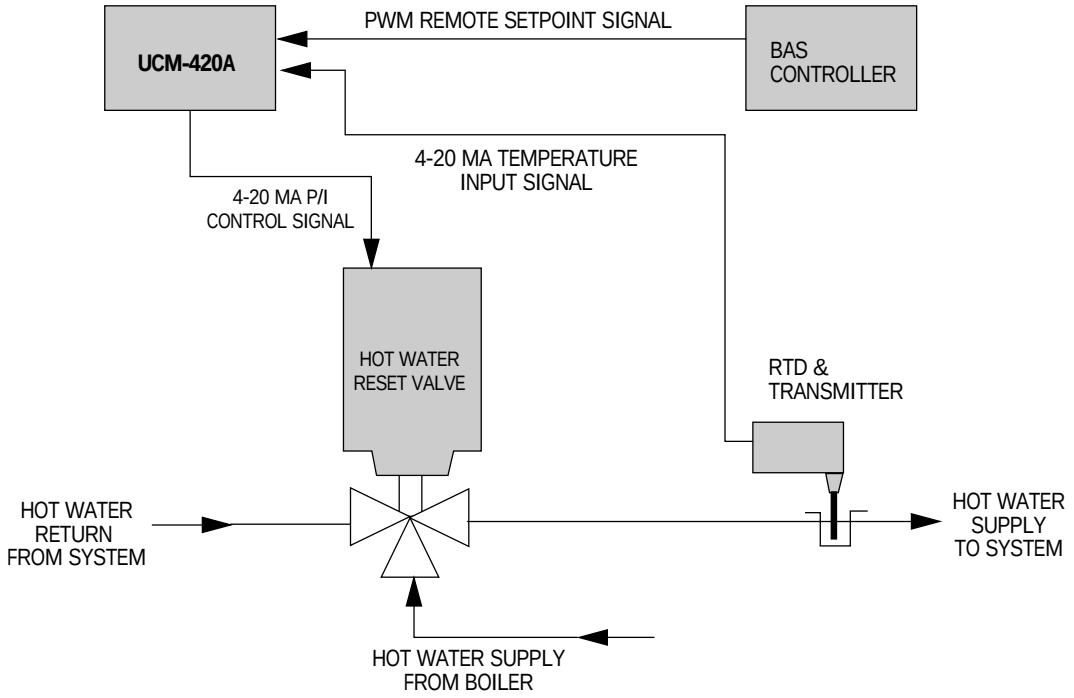
Modes of Operation

The UCM-420A is a versatile, low-cost microprocessor-based proportional/integral controller which may be used for a wide variety of control applications.
To select the mode of operation required, please review the descriptions on the following pages.

A Remote Setpoint Controller

When the **UCM-420A** is used as a remote setpoint controller, a 4-20 mA, 1-5 VDC or time-based pulse-width signal from a BAS controller sends a setpoint signal to the **UCM-420A**. The **UCM-420A** monitors a 4-20 mA, 1-5 VDC, or thermistor input from the process being controlled to provide a proportional/integral control signal to the controlled device. This signal may be direct- or reverse-acting. See **page 13** for instructions on operating the **UCM-420A** in this mode.

EXAMPLE: REMOTE SETPOINT CONTROLLER - Hot Water Reset
In this example, a BAS controller is monitoring outdoor air temperature and sending a time-based pulse-width signal to the **UCM-420A** to set the system hot water temperature. By using this control system, the BAS may also control the hot water temperature based on time of day, minimum space temperature, etc. The **UCM-420A** accepts the setpoint signal from the BAS and the input from the hot water temperature sensor and sends a proportional/integral control signal to the three-way valve to maintain the system hot water temperature as programmed.



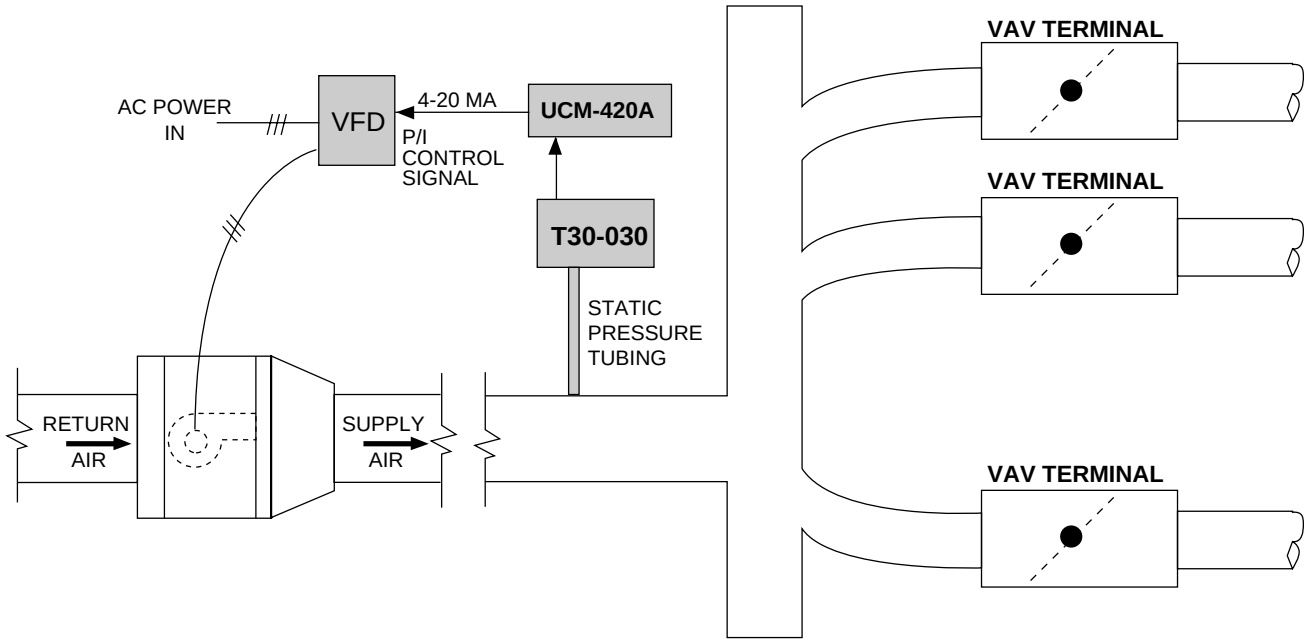
B Local Setpoint Controller

When the **UCM-420A** is used as a local setpoint controller, the potentiometer mounted on the unit may control the setpoint. If this is not desired, a **UCM-SPA** setpoint potentiometer or **PreCon "XA" Setpoint Option** on a temperature sensor may be wired to the "Local Setpoint" terminals as shown in the wiring diagrams. (The local setpoint may also be configured to accept a 4-20 mA or 1-5 VDC signal, although these signals would normally be used as a remote setpoint). A 4-20 mA, 1-5 VDC, or thermistor input (with a range of 50 to 90°F)* from the process being controlled allows the **UCM-420A** to monitor the system and provide a proportional/integral, direct- or reverse-acting signal to the device being controlled. See **page 16** for instructions on operating the **UCM-420A** in this mode.

**Other ranges available*

EXAMPLE: LOCAL SETPOINT CONTROLLER - Static Pressure Control

In this example, the input to the **UCM-420A** is a 4-20 mA signal from a pressure transducer that monitors duct pressure. The setpoint is adjusted by using the setpoint potentiometer mounted on the **UCM-420A**. The **UCM-420A** then sends a 4-20 mA control signal to the VFD which controls the AHU fan speed, which in turn, determines duct pressure.



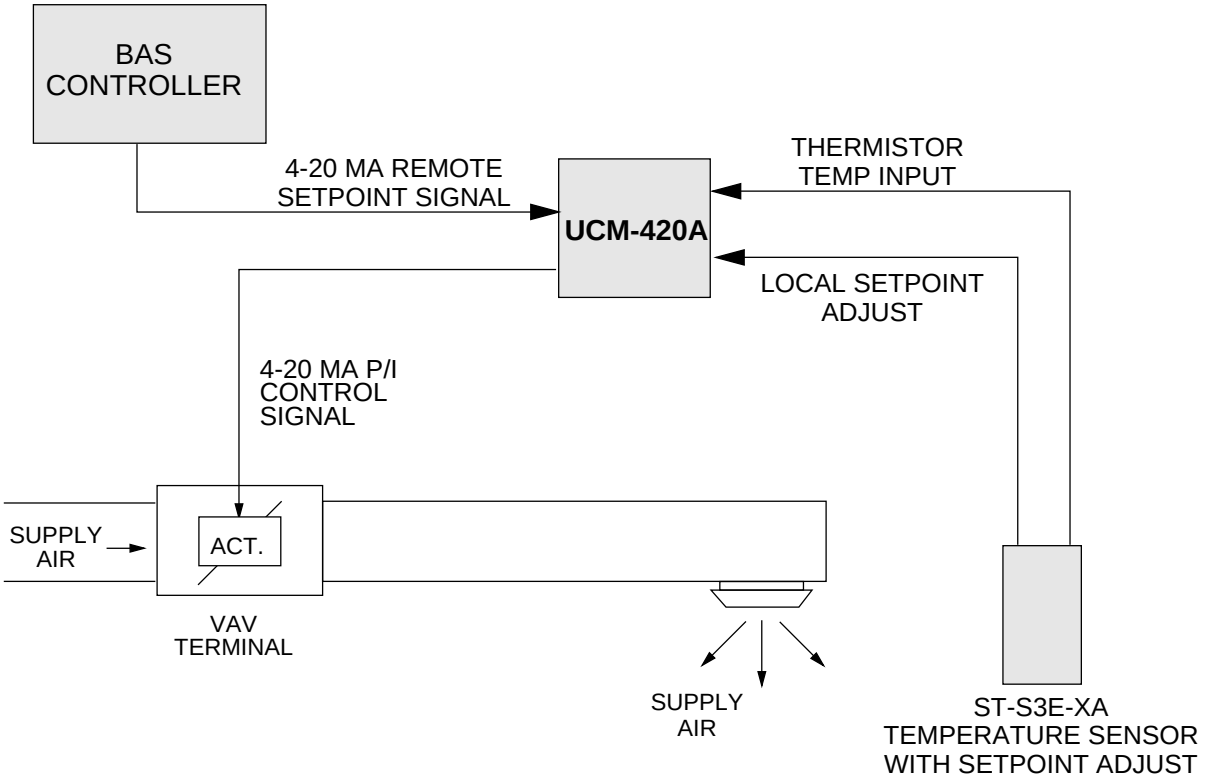
C Remote Setpoint Controller With Local Adjustment

When the **UCM-420A** is used as a remote setpoint controller with local adjustment, a 4-20 mA, 1-5 VDC, or time-based pulse-width signal from a BAS controller sends a setpoint signal to the **UCM-420A**. The setpoint potentiometer on the **UCM-420A** or a **UCM-SPA** setpoint potentiometer wired to the "Local Setpoint" terminals may then be used to adjust the setpoint ±12.5% of the input range, or a **PreCon "XA" Setpoint Option** on a temperature sensor may be used as a local setpoint and may adjust the setpoint ±9.4% of the input range. (A 4-20 mA or 1-5 VDC signal may also be used as the "Local Setpoint" signal, although these are normally remote setpoint signals. When these are used as local setpoints in this mode, they have the authority to adjust the setpoint ±12.5% of the input range.) A 4-20 mA, 1-5 VDC, or thermistor input (with a range of 50 to 90°F)* from the process being controlled allows the **UCM-420A** to monitor the system and provide a proportional/integral, direct- or reverse-acting signal to the device being controlled. See **page 18** for instructions on operating the **UCM-420A** in this mode.

** Other ranges available*

EXAMPLE: REMOTE SETPOINT CONTROLLER WITH LOCAL ADJUSTMENT - VAV Control

In this example, a **PreCon ST-S3E-XA Thermistor** with setpoint adjustment is located in the space being controlled. The setpoint is a 4-20 mA signal from a BAS controller. The **PreCon "XA"** setpoint adjuster will have authority to adjust the setpoint ±3.76°F. [(90 to 50°F*) x 0.094 = 3.76°F] In this example, the BAS controller could be programmed to send a setpoint signal for 72°F (12.8 mA) during the day, 82°F (16.8 mA) at night, etc.



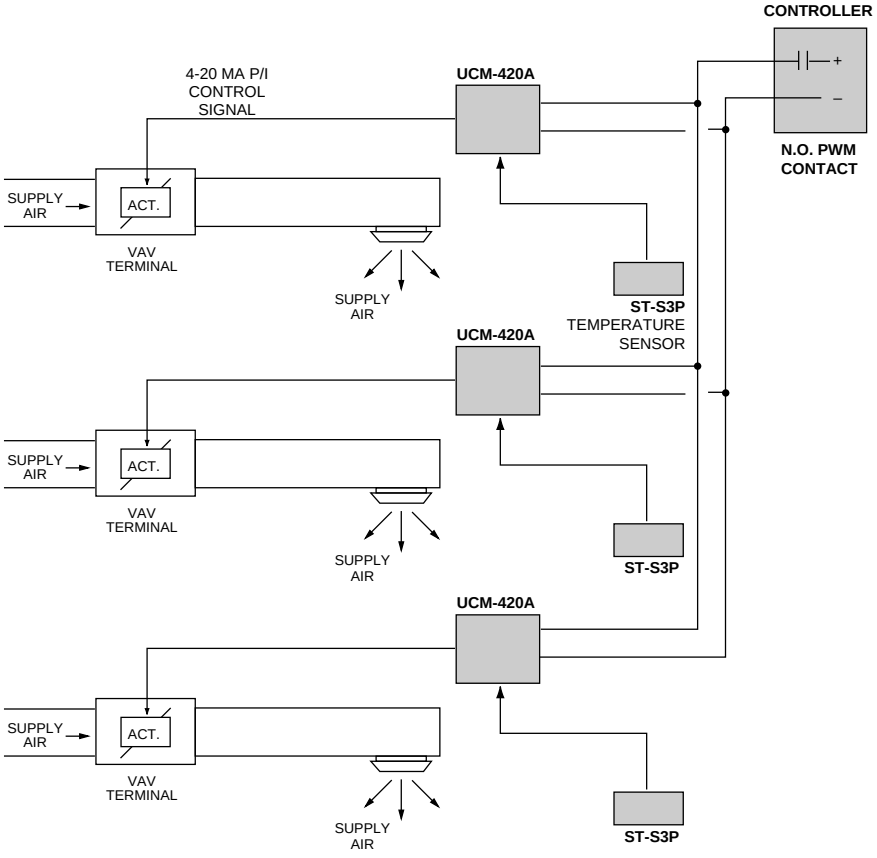
D Output Expander (Multiplexed PWM)

The **UCM-420A** may be operated in a multiplexed pulse-width modulation mode so that one BAS output may control up to eight groups of **UCM-420As** with each group able to have a different setpoint. When operated in this mode, each **UCM-420A** accepts a 4-20 mA, 1-5 VDC, or thermistor input (with a range of 50 to 90°F)* from the process being controlled. The "PWM INPUT" terminals are wired to the normally open contacts on a BAS controller. The BAS controller is programmed to send a series of 24 VAC or 24 VDC time-based pulse-width signals to the **UCM-420As**. These PWM signals select which units are to be addressed, and adjust their setpoints as required. The **UCM-420As** which are not being addressed ignore the new setpoint signal and continue to control based on their previous setpoint. Each **UCM-420A** will monitor its input signal and send a P/I control signal to the controlled device to maintain the required setpoint. When operated in this mode, the local setpoint may also be used to adjust the setpoint which has been set by the BAS controller. The setpoint potentiometer on the **UCM-420A** or a **UCM-SPA** setpoint potentiometer wired to the "Local Setpoint" terminals may be used to adjust the setpoint ±12.5% of the input range, or a **PreCon "XA" Setpoint Option** on a temperature sensor may be used as a local setpoint and may adjust the setpoint ±9.4% of the input range. (A 4-20 mA or 1-5 VDC signal may also be used as the "Local Setpoint" signal, although these are normally remote setpoint signals. When these are used as local setpoints in this mode, they have the authority to adjust the setpoint ±12.5% of the input range.) See **page 22** for instructions on operating the **UCM-420A** in this mode.

** Other ranges available*

EXAMPLE: UCM-420As USED AS OUTPUT EXPANDERS - Multiplexed VAV Control

In this example, one time-based pulse-width output from a BAS controller is used to send a setpoint signal to three **UCM-420A** setpoint controllers. Each of these may have a different setpoint. Each **UCM-420A** also accepts an input from a **PreCon Type 3 Temperature Sensor** in the space being controlled. The **UCM-420As** send 4-20 mA proportional/integral control signals to the VAV terminals so that the input matches the setpoint. Multiple **UCM-420As** may be assigned the same address so that they have the same setpoint. Eight different addresses are available so that up to eight groups of **UCM-420As** may be controlled by one BAS output. Instructions on setting **UCM-420A** addresses and how to update the setpoint with the BAS pulse-width signal are on **page 22**.



Modes of Operation (Cont.)

E Sample and Hold

The **UCM-420A** may be used to monitor and pass through a 4-20 mA or 1-5 VDC signal. If the signal being monitored is lost, the **UCM-420A** will output the last valid value for the signal until the signal returns. On a power loss, the signal is remembered up to six hours. When used in this mode the **UCM-420A** may be programmed to either reverse the signal being monitored, or pass it through direct. See **page 26** for instructions on operating the **UCM-420A** in this mode.

F Pulse-Width to 4-20 mA Converter (Single or Multiplexed)

In this mode the **UCM-420A** converts a time-based pulse-width AC or DC signal to a 4-20 mA output. By using the multiplexed mode, multiple **UCM-420As** may be controlled by one BAS output. In this mode all setpoint and input signals are ignored and the output signal is based on the pulse-width signal only. The output signal is retained up to 6 hours on a loss of power. Upon a power return, the saved value is output until a new pulse signal is received. The output may be direct- or reverse-acting. See **page 27** for instructions on operating the **UCM-420A** in this mode.

G 4-20 mA Signal Generator

If the device to be controlled by the **UCM-420A** needs to be calibrated before the system is started up, the **UCM-420A** may be used to generate a 4-20 mA output signal in 1 mA steps. In this mode the **UCM-420A** ignores all input and setpoint signals and outputs a signal from 4-20 mA when DIP switches are turned off or on as required. See **Page 29** for instructions on operating the **UCM-420A** in this mode.

THIS CONCLUDES **MODES OF OPERATION**. THE FOLLOWING **SET-UP INSTRUCTIONS** WILL GUIDE YOU THROUGH THE STEPS NECESSARY TO ACHIEVE THE MODE OF OPERATION YOU REQUIRE.

A SET-UP OF THE UCM-420A AS A REMOTE SETPOINT CONTROLLER (SEE PAGE 8)

STEP A-1 Set the DIP switches and jumpers as shown in **TABLE 1** for the remote setpoint to be used.

TABLE 1

Mode	Switch A1	Switch A2	Switch B1	Switch B2	Set jumper plugs on
4-20 mA Remote setpoint	ON	OFF	OFF	OFF	Position 1
1-5 VDC Remote setpoint	ON	OFF	OFF	OFF	Position 2
PWM Remote setpoint (no multiplex mode)	ON	OFF	ON	OFF	Position 1

FAILSAFE FEATURE
On a loss of power, the remote setpoint value is retained for up to 6 hours. Upon power return on a unit with PWM remote setpoint, the saved value will be used for control until a new PWM pulse is received.
Upon power return on a unit with analog remote setpoint, the saved value will be used to control until a new analog setpoint signal is received.
If power is not lost, but the analog remote setpoint signal is suddenly lost (because of a loose wire or Building Automation System failure), the **UCM-420A** will continue to control with the previous setpoint until a valid signal returns.

STEP A-2 If remote setpoint is set for pulse-width modulation, select the pulse-width time base from **TABLE 2**. If remote setpoint is by 4-20 mA or 1-5 VDC, proceed to **Step A-3.**

TABLE 2

Time base	B6	B7	B8
0.1-2.65 seconds	OFF	OFF	OFF
0.1-5.2 seconds	OFF	OFF	ON
0.1-12.85 seconds	OFF	ON	OFF
0.1-25.6 seconds	OFF	ON	ON
0.59-2.93 seconds	ON	OFF	OFF

$$\text{Setpoint} = \frac{(\text{pulse length})\,(\text{input range})}{\text{time base}} + \text{input lower value}$$

Example: If pulse length is 12.8 sec., time base is 25.6 sec., and the input sensor has a 4-20 mA range of 20° to 120°F, the setpoint could be determined as follows: $\text{Setpoint} = \frac{(12.8)\,(120-20)}{(25.6 - 0.1)} + 20 = 70.2°F$

Set-Up Instructions (Cont.)

STEP A-3

Select the type of input to be used and set the jumper per **TABLE 3**. The input may be a 4-20 mA or 1-5 volt signal that measures temperature, pressure, humidity, etc., or a **PreCon Type 3 Thermisto**r. If the thermistor is used, the range of the thermistor is 50° to 90°F.*

*Other ranges available

TABLE 3

Input	Set jumper plugs on
4-20 mA	Positions 7 and 11
1-5 VDC	Positions 8 and 11
PreCon Type 3 Thermistor	Positions 10 and 12

STEP A-4

Set switch A3 in the "ON" position for **Direct-Acting Control** and in the "OFF" position for **Reverse-Acting Control**. (*Direct-Acting Control* is when an increase in the input signal above setpoint causes the output signal to increase. *Reverse-Acting Control* is when an increase in the input signal above setpoint causes the output signal to decrease.)

STEP A-5

Set the proportional throttling range per **TABLE 4**. The throttling range is the amount of signal change at the input required to cause the output signal to go through its entire range (4-20 mA). For example, a 20% throttling range means that a 1 mA change in the input causes a 5 mA change in the output signal. When using the optional thermistor input, a 1°F change in input is the equivalent of 0.4 mA change in the mA input mode. The correct throttling range cannot be calculated, but must be adjusted for each application. Generally, systems that respond quickly should have a narrower throttling range than systems that respond slowly.

TABLE 4

Throttling Range	Switch A6	Switch A7	Switch A8
10%	OFF	OFF	OFF
20%	OFF	OFF	ON
35%	OFF	ON	OFF
50%	OFF	ON	ON
65%	ON	OFF	OFF
80%	ON	OFF	ON
90%	ON	ON	OFF
100%	ON	ON	ON

STEP A-6

Set the integral reset rate per **TABLE 5**. The integral reset feature corrects the output of the **UCM-420A** to compensate for the offset inherent in proportional-only controllers. The integral reset ramps the output in the direction that forces the input signal to exactly match the setpoint. The number of times per minute this offset is overcome by the output signal is the integral reset rate. If the output of the **UCM-420A** is used for digital control, set the integral reset "OFF."

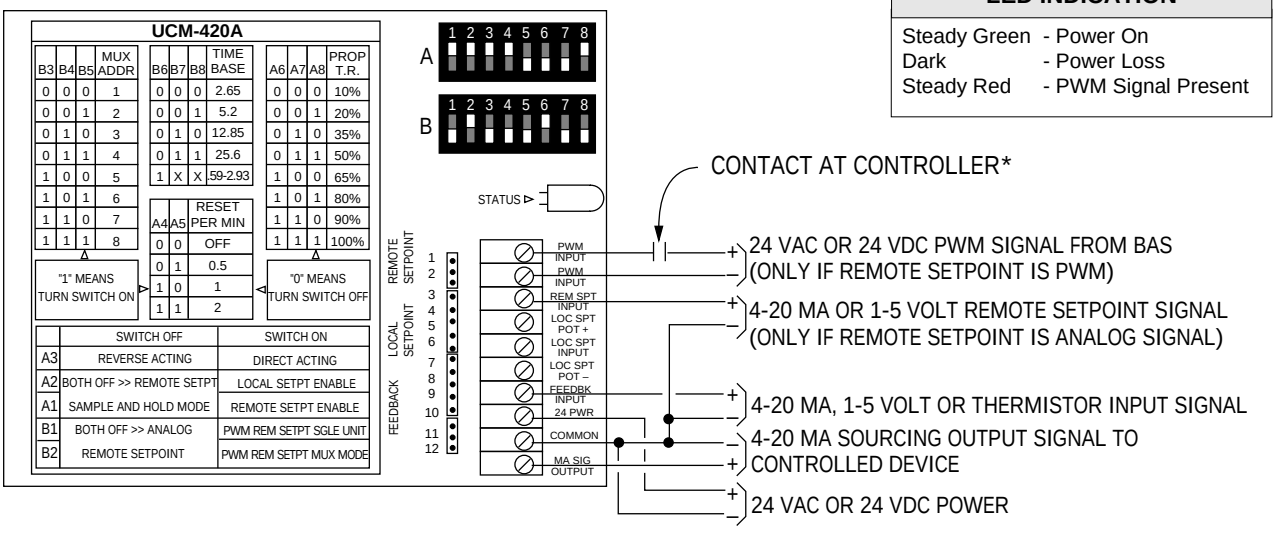
TABLE 5

Resets/Minute	Switch A4	Switch A5
Reset OFF	OFF	OFF
0.5 Resets/Minute	OFF	ON
1 Resets/Minute	ON	OFF
2 Resets/Minute	ON	ON

THIS CONCLUDES SET-UP OF THE UCM-420A AS A REMOTE SET-POINT CONTROLLER. WIRE THE UCM-420A PER THE WIRING DIAGRAM BELOW AND PER GENERAL WIRING DIAGRAMS.

WIRING THE UCM-420A AS A REMOTE SETPOINT CONTROLLER

LED INDICATION	
Steady Green	- Power On
Dark	- Power Loss
Steady Red	- PWM Signal Present



***NOTE: PWM contact at controller may switch either positive or negative leg of circuit, and PWM circuit may use the same power supply as the UCM-420A, or a separate power supply. See the General Wiring Diagram Section for detailed wiring.**

B SET-UP OF THE UCM-420A AS A LOCAL SETPOINT CONTROLLER (SEE PAGE 9)

STEP B-1 Set the DIP switches and jumpers as shown in **TABLE 6** for the local setpoint to be used.

TABLE 6

Mode	Switch A1	Switch A2	Set jumper plugs on
Three-wire pot Local setpoint	OFF	ON	Position 1 (No jumper on 3-6)
4-20 mA* Local setpoint	OFF	ON	Positions 1 & 3
1-5VDC* Local setpoint	OFF	ON	Positions 1 & 4
Two-wire pot* Local setpoint	OFF	ON	Positions 1 & 6

*__UCM-420A__ comes from the factory with an integral three-wire local setpoint potentiometer. To use any other local setpoint option, installer must first remove existing three wires from local setpoint terminals on **UCM-420A** terminal block.

STEP B-2 Select the type of input to be used and set the jumpers per **TABLE 7**. The input may be a 4-20 mA or 1-5 volt signal which measures temperature, pressure, humidity, etc. or a **PreCon Type 3 Thermisto**r. If the thermistor is used, the range of the thermistor input is 50 to 90°F.*

**Other ranges available*

TABLE 7

Input	Set jumper plugs on
4-20 mA	Positions 7 &11
1-5 VDC	Positions 8 & 11
PreCon Type 3 Thermistor	Positions 10 & 12

STEP B-3 Set switch A3 in the "ON" position for **Direct-Acting Control** and in the "OFF" position for **Reverse-Acting Control**. (*Direct-Acting Control* is when an increase in the input signal above setpoint causes the output signal to increase. *Reverse-Acting Control* is when an increase in the input signal above setpoint causes the output signal to decrease.)

STEP B-4 Set the proportional throttling range per **TABLE 8.** The throttling range is the amount of signal change at the input required to cause the output signal to go through its entire range (4-20 mA). For example, a 20% throttling range means that a 1 mA change in the input causes a 5 mA change in the output signal. When using the optional thermistor input, a 1°F change in input is the equivalent of 0.4 mA change in the mA input mode. The correct throttling range cannot be calculated, but must be adjusted for each application. Generally, systems that respond quickly should have a narrower throttling range than systems that respond slowly.

TABLE 8			
Throttling Range	**Switch A6**	**Switch A7**	**Switch A8**
10%	OFF	OFF	OFF
20%	OFF	OFF	ON
35%	OFF	ON	OFF
50%	OFF	ON	ON
65%	ON	OFF	OFF
80%	ON	OFF	ON
90%	ON	ON	OFF
100%	ON	ON	ON

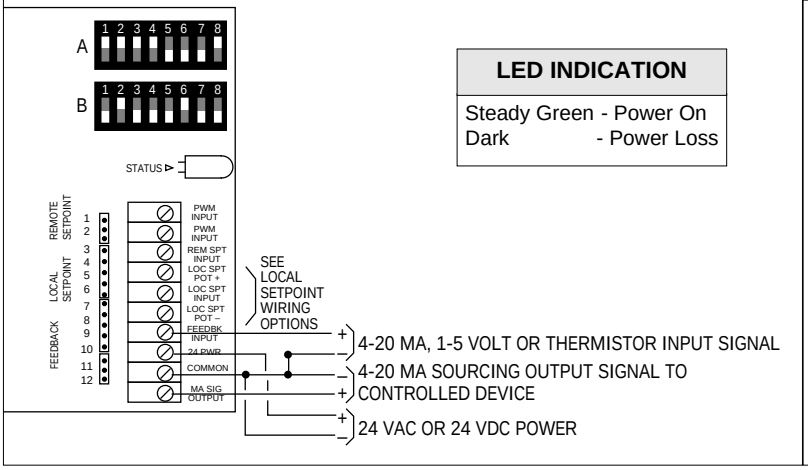
STEP B-5

Set the integral reset rate per **TABLE 9**. The integral reset feature corrects the output of the **UCM-420A** to compensate for the offset inherent in proportional-only controllers. The integral reset ramps the output in the direction that forces the input signal to exactly match the setpoint. The number of times per minute this offset is overcome by the output signal is the integral reset rate. If the output of the **UCM-420A** is used for digital control, set the integral reset rate "OFF."

TABLE 9		
Resets/Minute	**Switch A4**	**Switch A5**
Reset OFF	OFF	OFF
0.5 Resets/Minute	OFF	ON
1 Resets/Minute	ON	OFF
2 Resets/Minute	ON	ON

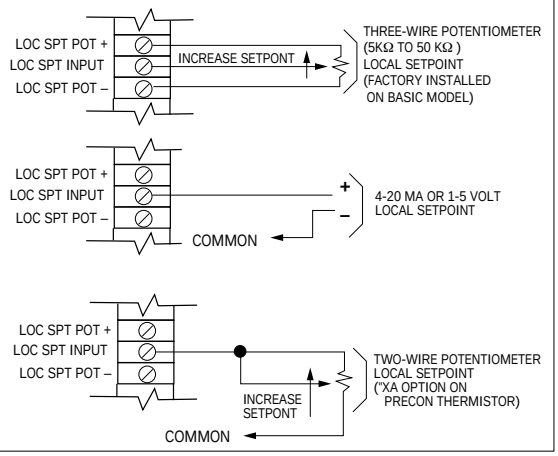
THIS CONCLUDES SET-UP OF THE UCM-420A AS A LOCAL SETPOINT CONTROLLER. WIRE THE UCM-420A PER THE WIRING DIAGRAM BELOW AND PER GENERAL WIRING DIAGRAMS.

WIRING THE UCM-420A AS A LOCAL SETPOINT CONTROLLER



LED INDICATION	
Steady Green	- Power On
Dark	- Power Loss

LOCAL SETPOINT WIRING OPTIONS



C SET-UP OF THE UCM-420A AS A REMOTE SETPOINT CONTROLLER WITH LOCAL ADJUSTMENT (SEE PAGE 10)

STEP C-1 Set Switch A1 and Switch A2 both in the "ON" position.

STEP C-2 Set the DIP switches and jumpers as shown in **TABLE 10** for the remote setpoint to be used.

TABLE 10

Remote Setpoint Signal	Switch B1	Switch B2	Set jumper plugs on
4-20 mA	OFF	OFF	Position 1
1-5 VDC	OFF	OFF	Position 2
PWM	ON	OFF	Position 1

FAILSAFE FEATURE
On a loss of power the remote setpoint value is retained for up to 6 hours. Upon power return on a unit with PWM remote setpoint, the saved value will be used for control until a new PWM pulse is received. Upon power return on a unit with analog remote setpoint, the saved value will be used to control until a new analog setpoint signal is received. If power is not lost, but the analog remote setpoint signal is suddenly lost (because of a loose wire or Building Automation System failure) the **UCM-420A** will continue to control with the previous setpoint until a valid signal returns.

STEP C-3 If Remote Setpoint is set for Pulse-Width Modulation, select the pulse-width time base from **TABLE 11**. If remote setpoint is by 4-20 mA or 1-5 VDC, proceed to **Step C-4**.

TABLE 11

Time base	Switch B6	Switch B7	Switch B8
0.1-2.65 seconds	OFF	OFF	OFF
0.1-5.2 seconds	OFF	OFF	ON
0.1-12.85 seconds	OFF	ON	OFF
0.1-25.6 seconds	OFF	ON	ON
0.59-2.93 seconds	ON	OFF	OFF

$$\text{Setpoint} = \frac{(\text{pulse length})\,(\text{input range})}{\text{time base}} + \text{input lower value}$$

Example: If pulse length is 12.8 sec., time base is 25.6 sec., and the input sensor has a 4-20 mA range of 20 to 120°F, the setpoint could be determined as follows:

$$\text{Setpoint} = \frac{(12.8)\,(120-20)}{(25.6 - 0.1)} + 20 = 70.2°\text{F}$$

STEP C-4

Set the DIP switches and jumpers as shown in **TABLE 12** for the local setpoint to be used.

TABLE 12

Local Setpoint Signal	Set jumper plugs on
Three-wire pot* local setpoint	No jumper on positions 3-6
4-20 mA* local setpoint	Position 3
1-5 VDC* local setpoint	Position 4
Two-wire* ("XA") pot local setpoint	Position 6

***NOTE: The UCM-420A comes from the factory with an integral three-wire local setpoint potentiometer installed and wired. To use any other local setpoint option (or three-wire potentiometer separate from the UCM-420A) installer must first remove the existing three wires from the "LOCAL SETPOINT" terminals on the UCM-420A.**

STEP C-5

Select the type of input to be used per **TABLE 13**. The input may be a 4-20 mA or 1-5 volt signal which measures temperature, pressure, humidity, etc. or a **PreCon Type 3 Thermistor**. If the thermistor is used, the range of the thermistor input is 50 to 90° F.*

**Other ranges available*

TABLE 13

Input	Set jumper plugs on
4-20 mA	Positions 7 & 11
1-5 VDC	Positions 8 & 11
PreCon Type 3 Thermistor	Positions 10 & 12

STEP C-6

Set switch A3 in the "ON" position for **Direct-Acting Control** and in the "OFF" position for **Reverse-Acting Control**. (*Direct-Acting Control* is when an increase in the input signal above the setpoint causes the output signal to increase. *Reverse-Acting Control* is when an increase in the input signal above the setpoint causes the output signal to decrease.)

Set-Up Instructions (Cont.)

STEP C-7

Set the proportional throttling range per **TABLE 14**. The throttling range is the amount of signal change at the input required to cause the output signal to go through its entire range (4-20 mA). For example, a 20% throttling range means that a 1 mA change in the input causes a 5 mA change in the output signal. When using the optional thermistor input, a 1°F change in input is the equivalent of 0.4 mA change in the mA input mode. The correct throttling range cannot be calculated, but must be adjusted for each application. Generally, systems that respond quickly should have a narrower throttling range than systems that respond slowly.

TABLE 14

Throttling range	Switch A6	Switch A7	Switch A8
10%	OFF	OFF	OFF
20%	OFF	OFF	ON
35%	OFF	ON	OFF
50%	OFF	ON	ON
65%	ON	OFF	OFF
80%	ON	OFF	ON
90%	ON	ON	OFF
100%	ON	ON	ON

STEP C-8

Set the integral reset rate per **TABLE 15**. The integral reset feature corrects the output of the **UCM-420A** to compensate for the offset inherent in proportional-only controllers. The integral reset ramps the output in the direction which forces the input signal to exactly match the setpoint. The number of times per minute this offset is overcome by the output signal is the integral reset rate. If the output of the **UCM-420A** is used for digital control, set the integral reset rate "OFF."

TABLE 15

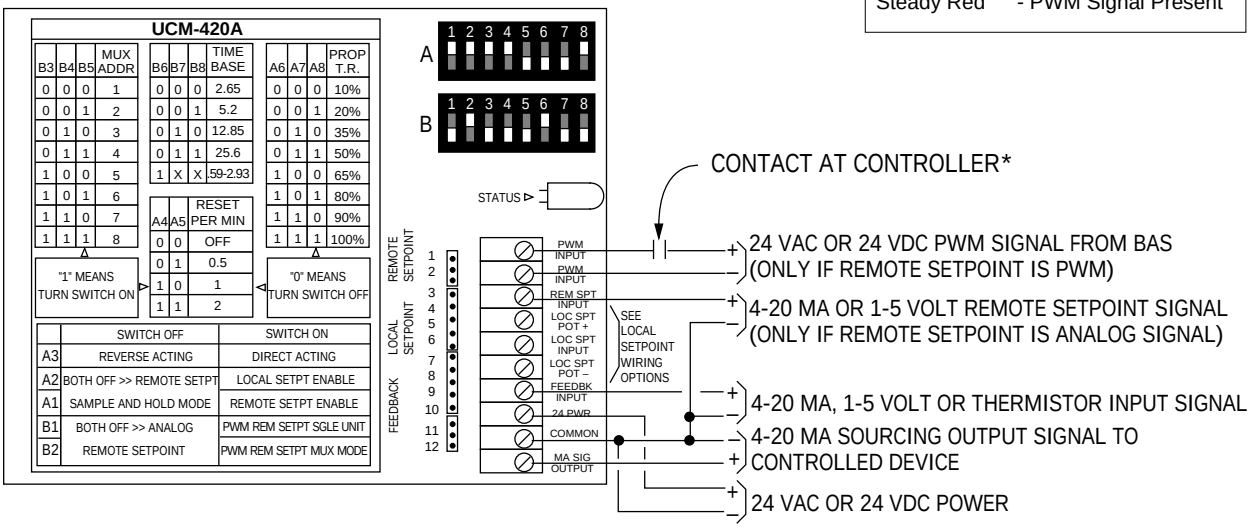
Resets/Minute	Switch A4	Switch A5
Reset OFF	OFF	OFF
0.5 Resets/Minute	OFF	ON
1 Resets/Minute	ON	OFF
2 Resets/Minute	ON	ON

THIS CONCLUDES SET-UP OF THE UCM-420A AS A REMOTE SETPOINT CONTROLLER WITH LOCAL ADJUSTMENT. WIRE THE UCM-420A PER THE WIRING DIAGRAM BELOW AND PER GENERAL WIRING DIAGRAMS.

Set-Up Instructions (Cont.)

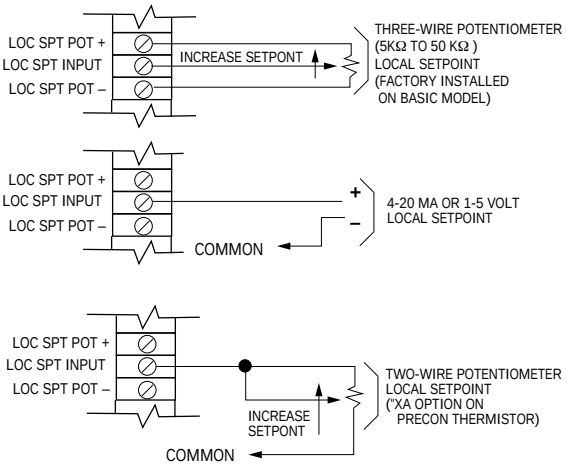
WIRING DIAGRAM - UCM-420A AS A REMOTE SETPOINT CONTROLLER WITH LOCAL ADJUSTMENT

LED INDICATION	
Steady Green	- Power On
Dark	- Power Loss
Steady Red	- PWM Signal Present



***NOTE: PWM contact at controller may switch either positive or negative leg of circuit, and PWM circuit may use the same power supply as the UCM-420A or a separate power supply. See the General Wiring Diagram Section for detailed wiring.**

LOCAL SETPOINT WIRING OPTIONS



D SET-UP OF THE UCM-420A AS AN OUTPUT EXPANDER WITH MULTIPLEXED PWM INPUT (SEE PAGE 11)

STEP D-1

Select either a multiplexed remote setpoint with no local adjustment or a multiplexed remote setpoint with local adjustment and set DIP switches and jumpers per **TABLE 16**. If remote and local setpoints are both enabled, the remote setpoint establishes the setpoint and the local setpoint has ±12.5% of the input adjustment around this point. If the local setpoint adjustment is by a **PreCon Two-Wire Potentiometer** (as used in the "XA" option on PreCon Temperature Sensors) the local setpoint adjustment is ±9.4% instead of ±12.5%.

TABLE 16

Mode	Switch A1	Switch A2	Switch B1	Switch B2	Set jumper plugs on
MUX Remote setpoint, no local setpoint	ON	OFF	OFF	ON	NONE
MUX Remote setpoint, 4-20 mA local setpoint	ON	ON	OFF	ON	Positions 1 & 3
MUX Remote setpoint, 1-5V local setpoint	ON	ON	OFF	ON	Positions 1 & 4
MUX Remote setpoint, three-wire local setpoint	ON	ON	OFF	ON	Position 1 (no jumper on 3-6)
MUX Remote setpoint, two-wire local setpoint	ON	ON	OFF	ON	Positions 1 & 6N

STEP D-2

In the multiplexed PWM mode, each **UCM-420A** is assigned an address 1-8 so that it may be independently updated by the Building Automation System. Multiple **UCM-420As** may be assigned the same address. Assign each **UCM-420A** an address per **TABLE 17**. All **UCM-420As** with the same address must have the same setpoint.

TABLE 17

Multiplex Address	Switch B3	Switch B4	Switch B5
1	OFF	OFF	OFF
2	OFF	OFF	ON
3	OFF	ON	OFF
4	OFF	ON	ON
5	ON	OFF	OFF
6	ON	OFF	ON
7	ON	ON	OFF
8	ON	ON	ON

STEP D-3

Select the pulse-width time base per **TABLE 18** and set each **UCM-420A** for the time base required. The 2.65 second time base is not recommended for multiplexed operation unless the BAS controller guarantees an accuracy of 0.05 seconds or better on its PWM output.

TABLE 18

Time base	B6	B7	B8
0.1-2.65 seconds	OFF	OFF	OFF
0.1-5.2 seconds	OFF	OFF	ON
0.1-12.85 seconds	OFF	ON	OFF
0.1-25.6 seconds	OFF	ON	ON

MULTIPLEXED OPERATION

The pulse-width input is optoisolated and can accept an 24 VAC or 24 VDC signal from any source with or without a common ground. The sequence for updating a **UCM-420A** setpoint in the multiplexed mode is as follows:

1. The BAS Controller sends an “Attention” pulse which is one second longer than the maximum pulse for the time base selected.
2. The BAS Controller then sends a “Select” pulse of one of eight possible time periods to select which **UCM-420A** address’s to be updated. See TABLE 19 for the “Address” pulse times for the different time bases. The **UCM-420A**s which receive a “Select” pulse which matches their address then wait for a set-point pulse. All other **UCM-420A**s ignore the setpoint pulse and return to the normal operating mode.
3. The BAS Controller then sends the new “Setpoint” pulse to the **UCM-420A** which has been selected. The **UCM-420A** accepts the new setpoint and returns to the normal operating mode. Multiple **UCM-420A**s may be assigned the same address. In this case, all **UCM-420A**s with the selected address will receive the new setpoint. **Setpoint = $\frac{\text{pulse length (input range)}}{\text{time base}}$ + input lower value**

Example: If pulse length is 12.8 sec., time base is 25.6 sec., and the input sensor has a 4-20 mA range of 20 to 120°F, the setpoint could be determined as follows: **Setpoint = $\frac{12.8\ (120\text{-}20)}{(25.6 - 0.1)}$ +20 = 70.2°F**

TABLE 19

Address	2.65 sec* time base	5.2 sec time base	12.85 sec time base	25.6 sec time base
1	0.2	0.4	0.9	1.6
2	0.6	1.0	2.5	4.8
3	0.9	1.7	4.1	8
4	1.2	2.3	5.7	11.2
5	1.5	3.0	7.3	14.4
6	1.9	3.6	8.9	17.6
7	2.2	4.3	10.5	20.9
8	2.5	4.9	12.1	24

* The 2.65 second time base is not recommended for the MUX mode unless the BAS guarantees an accuracy of 0.05 seconds or better on its PWM output.

Set-Up Instructions (Cont.)

STEP D-4

Select the type of input to be used and set jumpers per **TABLE 20**. The input may be a 4-20 mA or 1-5V signal which measures temperature, pressure, humidity, etc. or a **PreCon** Type 3 Thermistor.

TABLE 20

Input	Set jumper plugs on
4-20 mA	Positions 7 & 11
1-5 VDC	Positions 8 & 11
PreCon Type 3 Thermistor	Positions 10 & 12

STEP D-5

Set switch A3 in the "ON" position for **DIrect-Acting Control** and in the "OFF" position for **Reverse-Acting Control**. (*Direct-Acting Control* is when an increase in the input signal above setpoint causes the output signal to increase. *Reverse-Acting Control* is when an increase in the input signal above setpoint causes the output signal to decrease.

STEP D-6

Set the proportional throttling range per **TABLE 21**. The throttling range is the amount of signal change of the input required to cause the output signal to go through its entire range (4-20 mA). For example, a 20% throttling range means that a 1 mA change in the input signal causes a 5 mA change in the output signal. When using the optional thermistor input, a 1°F change in input is the equivalent of 0.4 mA change in the mA input mode. The correct throttling range cannot be calculated, but must be adjusted for each application. Generally, systems that respond quickly should have a narrower throttling range than systems that respond slowly.

TABLE 21

SETTING THROTTLING RANGE

Throttling Range	Switch A6	Switch A7	Switch A8
10%	OFF	OFF	OFF
20%	OFF	OFF	ON
35%	OFF	ON	OFF
50%	OFF	ON	ON
65%	ON	OFF	OFF
80%	ON	OFF	ON
90%	ON	ON	OFF
100%	ON	ON	ON

STEP D-8

Set the integral reset rate per **TABLE 22**. The integral reset feature corrects the output of the **UCM-420A** to compensate for the offset inherent in proportional controllers. The integral reset ramps the output in the direction that forces the input signal to exactly match the setpoint. The number of times per minute this offset is overcome by the output signal is the integral reset rate. If the output of the **UCM-420A** is used for digital control, set the integral reset rate "OFF."

TABLE 22

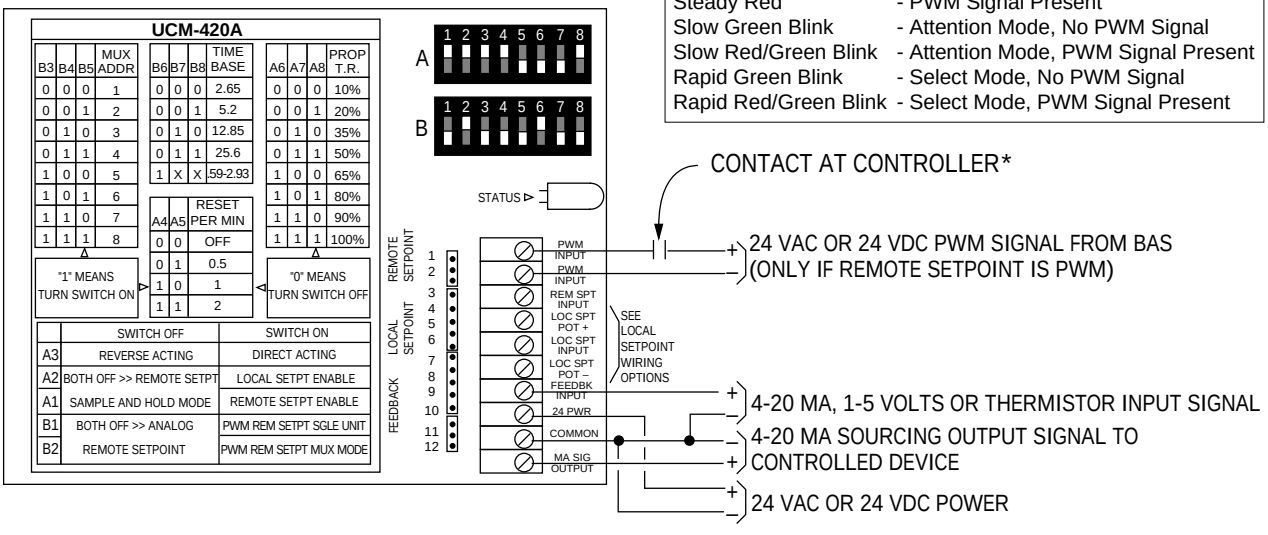
Resets/Minute	Switch A4	Switch A5
Reset OFF	OFF	OFF
0.5 Resets/Minute	OFF	ON
1 Reset/Minute	ON	OFF
2 Resets/Minute	ON	ON

THIS CONCLUDES SET-UP OF THE UCM-420A AS AN OUTPUT EXPANDER (MUX OPERATION). WIRE THE UCM-420A PER THE WIRING DIAGRAM BELOW AND PER GENERAL WIRING DIAGRAMS.

WIRING OF THE UCM-420 AS AN OUTPUT EXPANDER (MUX OPERATIONS)

LED INDICATION

Steady Green	- Power On
Dark	- Power Loss
Steady Red	- PWM Signal Present
Slow Green Blink	- Attention Mode, No PWM Signal
Slow Red/Green Blink	- Attention Mode, PWM Signal Present
Rapid Green Blink	- Select Mode, No PWM Signal
Rapid Red/Green Blink	- Select Mode, PWM Signal Present



***NOTE: PWM contact at controller may switch either positive or negative leg of circuit, and PWM circuit may use the same power supply as the UCM-420A or a separate power supply. See the General Wiring Diagram Section for detailed wiring.**

D SET-UP OF THE UCM-420A IN THE SAMPLE AND HOLD MODE (SEE PAGE 12)

STEP E-1

For Direct-Acting Output (4-20 mA in and 4-20 mA out or 1-5 VDC in and 1-5 VDC out) switch A3 and A4 should be “ON” and all other switches ”OFF”. For Reverse Acting Output (4-20 mA in and 20-4 mA out or 1-5 VDC in and 5-1 VDC out) switch A4 should be “ON” and all other switches “OFF.”

STEP E-2

Set the jumpers as shown in **TABLE 23** for the signal being monitored.

TABLE 23

Signal Monitored	Set jumper plugs on
4-20 mA	Positions 1, 7, & 11
1-5 VDC	Positions 2, 7, & 11

OPERATION

The **UCM-420A** may be used to sample an analog signal and hold the value on a loss of signal. In this mode of operation, the analog remote setpoint signal is sampled and the local setpoint and input signals are ignored. The “lost” threshold for the sampled signal is 3.2 mA or 0.8 volts.

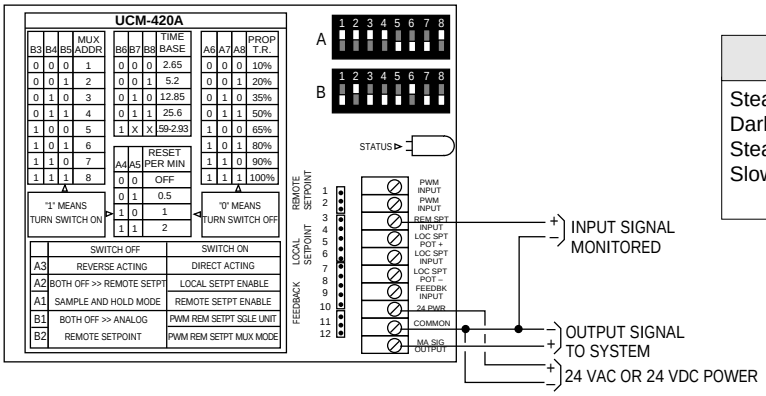
The remote setpoint signal is sampled once per second. If the new value is within 6% of the previous reading, the new value is passed through to the output.

If the new sample of the signal is more than 6% higher or lower than the previous sample but is not “lost” (the input signal is moving), the old output value is held. The new sample is then saved for comparison against the next sample. When the input signal stops moving so that two consecutive samples are within 6% of each other, the output updates.

When the newest sample of the signal drops below the “lost” threshold value, the old value is held at the current output.

On power loss, the current output value is remembered up to 6 hours. On power return, if the sampled signal is “lost,” the old value will be output until a good signal is received.

WIRING OF THE UCM-420A IN THE SAMPLE AND HOLD MODE



LED INDICATION	
Steady Green	- Signal O.K.
Dark	- Power Loss
Steady Red	- Signal Lost, Output Being Held
Slow Red/Green Blink	- Signal Changing Rapidly. Output Being Held

F SET-UP OF THE UCM-420A AS A PULSE WIDTH TO 4-20 MA CONVERTER (SEE PAGE 12)

STEP F-1

The **UCM-420A** may be used to convert a time-based pulse-width AC or DC input signal to a 4-20 mA output signal. By using the multiplexed mode, multiple **UCM-420A**s may be controlled by one BAS output. In this mode, the **UCM-420A** output is based solely on the pulse-width signal and selected time base. Remote setpoint, local setpoint and input are ignored. The output value is retained up to 6 hours on a loss of power. Upon power return, the saved value is output until a new pulse signal is received. The output may be direct- or reverse-acting. Select single unit PWM or multiplexed PWM by setting the switches as shown in **TABLE 24**.

TABLE 24

Mode	Switch A1	Switch A2	Switch B1	Switch B2
Single Unit PWM	OFF	OFF	ON	OFF
Multiplexed PWM	OFF	OFF	OFF	ON

STEP F-2

Select the time base for the control signal by setting DIP switches per **TABLE 25**.

TABLE 25

Time base	B6	B7	B8
0.1-2.65 seconds	OFF	OFF	OFF
0.1-5.2 seconds	OFF	OFF	ON
0.1-12.85 seconds	OFF	ON	OFF
0.1-25.6 seconds	OFF	ON	ON
0.59-2.93 seconds	ON	ON	ON

STEP F-3

If the output is to be **Direct-Acting**, switch A3 is to be in the “ON” position. If the output is to be **Reverse-Acting**, A3 is to be in the “OFF” position. In the *Direct-Acting mode*, the minimum pulse input causes a 4 mA output signal. As the length of the pulse-width input signal is increased, the output signal will increase. In the *Reverse-Acting mode*, the minimum pulse input causes a 20 mA output signal. As the length of the pulse-width input signal is increased, the output signal will decrease.

STEP F-4

If the **UCM-420As** are to be multiplexed, set the address of each unit from **TABLE 26**. Multiple units may have the same address.

Set-Up Instructions (Cont.)

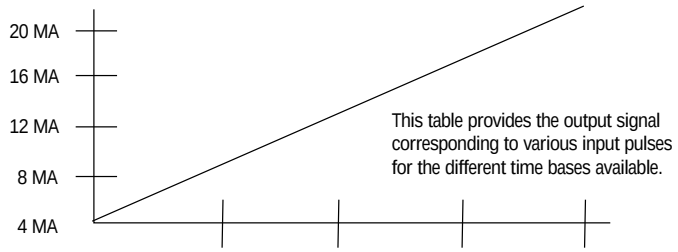
TABLE 26

Multiplex Address	Switch B3	Switch B4	Switch B5
1	OFF	OFF	OFF
2	OFF	OFF	ON
3	OFF	ON	OFF
4	OFF	ON	ON
5	ON	OFF	OFF
6	ON	OFF	ON
7	ON	ON	OFF
8	ON	ON	ON

STEP F-5

See "Multiplexed Operation" on page 11 for a description of the UCM-420A operation in the multiplexed mode.

TABLE 27

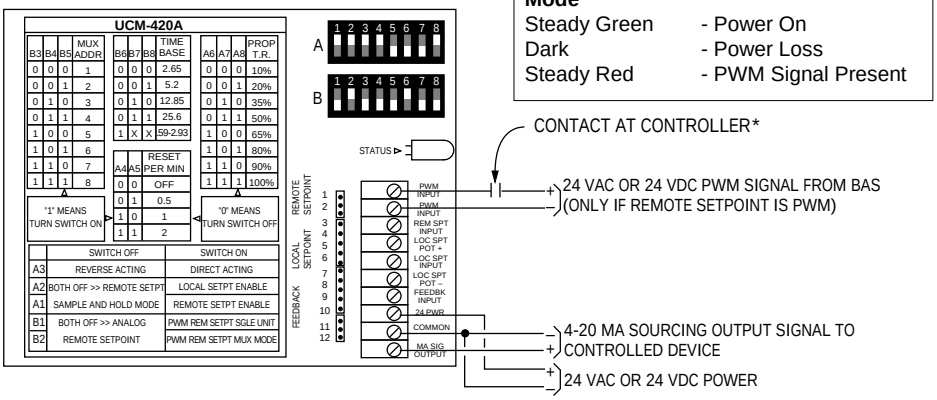


0.1	0.66	1.33	1.99	2.65
0.1	1.3	2.6	3.9	5.2
0.1	3.21	6.43	9.64	12.85
0.1	6.4	12.8	38.4	25.6
0.59	1.18	1.76	4.69	2.93

THIS CONCLUDES THE SET-UP OF THE UCM-420A AS A PULSE WIDTH TO 4-20 MA CONVERTER. WIRE THE UCM-420A PER THE WIRING DIAGRAM BELOW AND THE GENERAL WIRING DIAGRAMS.

WIRING OF THE UCM-420A AS A PWM TO 4-20 mA CONVERTER

***NOTE: PWM contact at controller may switch either positive or negative leg of circuit, and PWM circuit may use the same power supply as the UCM-420A or a separate power supply. See the General Wiring Diagram Section for detailed wiring.**



LED INDICATION (No MUX)

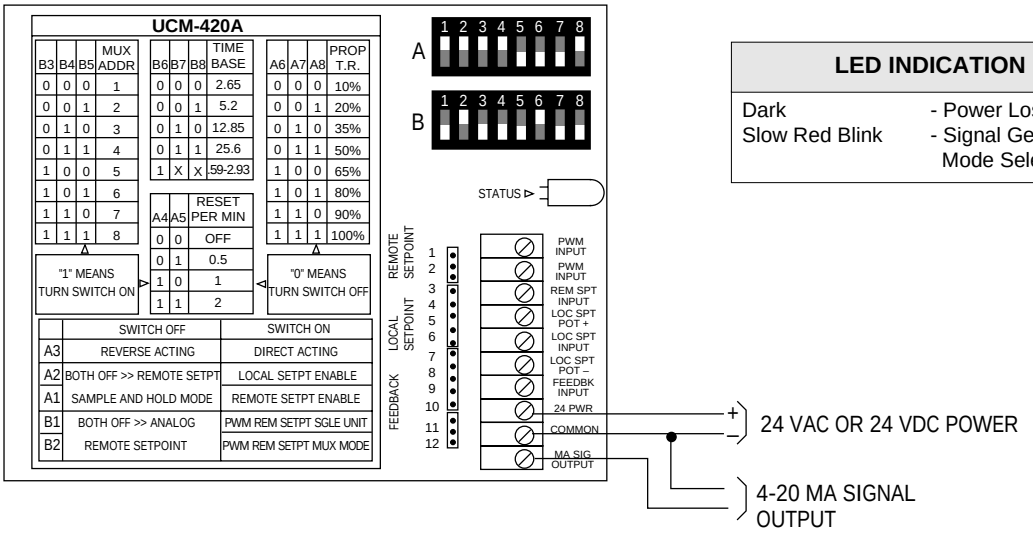
See page 25 for LED indication in MUX Mode

Steady Green	- Power On
Dark	- Power Loss
Steady Red	- PWM Signal Present

G SET-UP OF THE UCM-420A AS A SIGNAL GENERATOR (SEE PAGE 12)

The **UCM-420A** may be used as a 4-20 mA signal generator with no input or setpoint signals. This allows equipment driven by the **UCM-420A** to be calibrated before system start-up. This mode of operation supplies a 4-20 mA signal in 1 mA steps. If the **UCM-420A** is installed when the signal generator mode is to be used, wiring should be done in accordance with the proper wiring diagram for the mode of operation for which the **UCM-420A** is to be used. If the **UCM-420A** is not installed when the signal generator mode is to be used, wire per the wiring diagram below.

WIRING OF THE UCM-420A AS A 4-20 MA SIGNAL GENERATOR



LED INDICATION	
Dark	- Power Loss
Slow Red Blink	- Signal Generator Mode Selected

STEP G-1	Remove power from the **UCM-420A.**
STEP G-2	Set all sixteen DIP switches in the "OFF" position.
STEP G-3	Power up the unit. The status LED will flash RED and the output will go to 4 mA.
STEP G-4	Any even mA value can then be output by turning on the DIP switch shown in **TABLE 28**. The **UCM-420A** will output a signal for the highest value switch that is turned on; the status of lower value switches makes no difference. For example, if all switches are off except A6 and A5, the **UCM-420A** will output the value for A6 which is 10 mA.

Set-Up Instructions (Cont.)

TABLE 28			
DIP switch	**mA Output**	**DIP switch**	**mA Output**
All OFF	4	B1	13
A1	5	B2	14
A2	6	B3	15
A3	7	B4	16
A4	8	B5	17
A5	9	B6	18
A6	10	B7	19
A7	11	B8	20
A8	12		

Ordering Information

ORDERING INFORMATION	
UCM-420A	Basic model including thermistor input and built-in local setpoint potentiometer
UCO-47	DIN rail mount (mounts on DIN 3F)
UCM-SPA	Local setpoint potentiometer on stainless steel plate

The standard unit stocked by **Kele** is the **UCM-420A** which includes a local setpoint potentiometer and accepts a thermistor input. On large quantities (100 minimum), special configurations are available. Contact **Kele** for special pricing.

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