

**Model PRC-20 –  
AR/t & RTR®**

**Water Treatment Control System**

**Installation &  
Operation Manual**



**IMPORTANT ! Read this manual before  
attempting any installation, wiring or operation.**



## SCOPE OF THE MANUAL

This manual contains information concerning the installation, operation and maintenance of the Badger® PRC-20 with AR/t or RTR® Water Conditioning Control System. To ensure proper performance of the system, the instructions given in this manual should be thoroughly understood and followed.

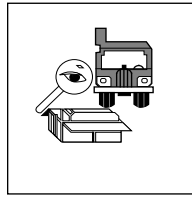
Keep the manual in a readily, accessible location for future reference.

Changes and additions to the original edition of this manual will be covered by a "Change Notice" supplied with the manual. The change notice will explain any differences between the product received and the product described in this manual.

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## UNPACKING & INSPECTION



To avoid damage in transit, Badger products are shipped to the customer in special shipping containers. Upon receipt of the product, perform the following unpacking and inspection procedures.

Note: If damage to the shipping container is evident upon receipt, request the carrier to be present when the product is unpacked.

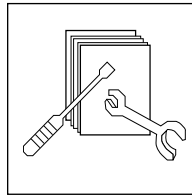
a. Carefully open the shipping container following any instructions that may be marked on the box. Remove all cushioning material surrounding the product and carefully lift the product from the container.

Retain carton and packing material for use in re-shipment or storage of unit.

b. Visually inspect the product and applicable accessories for any physical damage such as scratches, loose or broken parts or any other sign of damage that may have occurred during shipment.

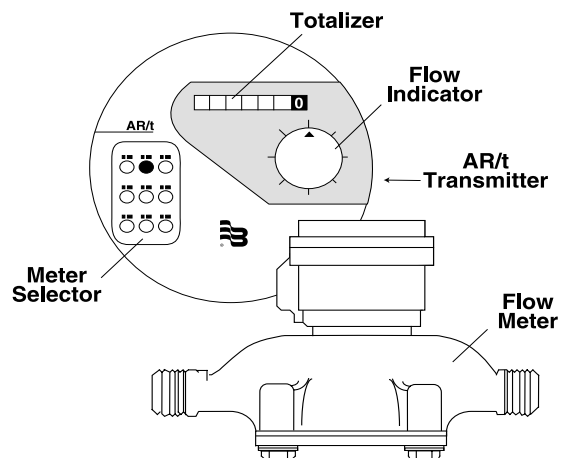
Note: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damaged in transit is the sole responsibility of the customer.

## INSTALLATION



The control system consists of a Badger Disc or Turbo meter with the AR/t or RTR® pulse transmitter and the PRC-20 Conditioning Controller. Normally, the transmitter will be mounted on the meter. It does not require any additional mounting procedure. All transmitters use a simple bayonet mount and a seal screw to attach to the meter.

Note: Always be sure to match the transmitter to the proper meter. A red dot on the AR/t transmitter dial indicates the meter model and size for which the transmitter is intended. The RTR dial face has the model designation of the appropriate meter.



## OPERATION

The basic function of the Badger® PRC-20 controller is to provide a relay output signal to external equipment to control tank regeneration. Regeneration may be started automatically when a predetermined amount of water is measured by the water meter, or may be manually started by a front panel or remote Start input. The batch size, up to 99,999,900 gallons, is preset on the front panel, and the display counts down to zero. Regeneration is stopped either after a predetermined amount of time expires, or a front panel or remote Stop input is received. The timeout, up to 9,999 seconds is set on the front panel.

The PRC-20 is programmed by the installer to operate either in Auto or Manual mode. In Auto mode, regardless of whether regeneration was started by the batch count reaching zero, or by a Start input, the count will immediately return to the preset amount and count down as pulses are received from the meter. Regeneration will end when the timeout period elapses, or when a Stop input occurs. In Manual mode, the count will remain at zero, and regeneration will continue until a Stop input occurs.

To avoid simultaneous regeneration of multiple tanks, a lockout signal can prevent a controller from starting regeneration at the end of a batch. If a lockout is active when the batch counter reaches zero, or when a Start input is received, the controller will remember to start regeneration as soon as the lockout signal is terminated. Furthermore, the running batch count can be adjusted on the front panel as another method of avoiding simultaneous regeneration.

When power to the control is lost, the PRC-20 will store the running batch count in memory. If used in the Auto mode, and a regeneration cycle had been started when power was lost, it will also store the time remaining in the cycle. The unit stores these values in non-volatile memory, which requires no battery, and will retain these values.

When power to the control is turned back on, the unit will either continue from where it is left off when power was lost, or it will automatically initiate a regeneration cycle. If the power up start input is disabled, the PRC-20 will simply continue counting from the retained time value, and/or timing the regeneration cycle from the retained time value. If the power up start input is enabled, the PRC-20 will start a regeneration cycle, just as if the batch had counted down to zero, or the operator had manually started one.

## MOUNTING

The PRC-20 controller comes in a rugged, watertight polycarbonate enclosure intended for wall or panel mounting.

When mounting the unit select a location which has adequate ventilation, protection against mechanical shock and accessibility for operation and service.

Operating Temperature: 32° to 122° F (0° to 50° C)  
Operating Humidity: Up to 85% non-condensing

## Wall or Panel Mount

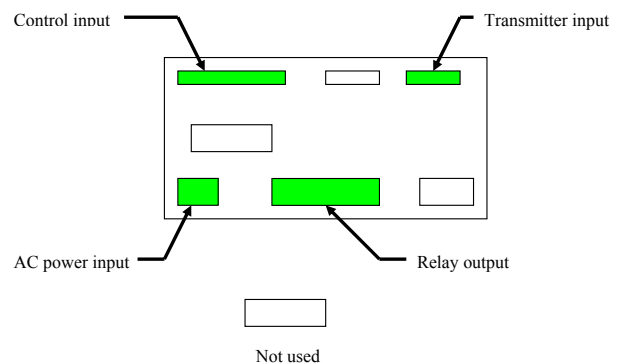
1. Using the appropriate mounting hardware attach the back part of the housing to the mounting surface.
2. Wire the unit.

## WIRING

There are seven terminal blocks on the rear of the PRC-20 controller. Three of them will require wiring, one may require wiring, and three will not require any wires. **Do not use any of the unused terminals in the following diagrams for wiring points.** Damage to the controller could result. The three terminal blocks that require wiring are:

1. AC power input
2. Transmitter input
3. Regeneration relay output

### TERMINAL BLOCK LAYOUT



The control input terminal block will require wiring only if a remote Start or Stop input is used, if a lockout input is needed, or if power up start must be enabled.

The remote Start and Stop inputs duplicate the functions of the front panel Start and Stop buttons as described above. However, there are some differences to be aware of. The front panel Start and Stop buttons require a second press of the button within ten seconds of the first press to initiate a start or stop. The rear terminal Start and Stop inputs initiate the function immediately. The front panel Start and Stop buttons act as momentary switches, which means that the action occurs when the button is pressed, and is not repeated until the button is released and then pressed again. The rear terminal inputs act as maintained inputs.

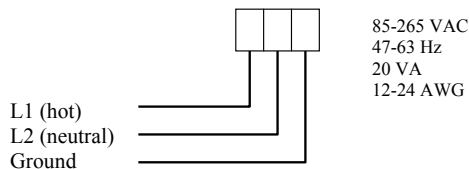
If the Start terminal is switched to ground, the regeneration output will turn on and remain on as long as the input is grounded. A Stop input will always override a Start input, for as long as the Stop input is connected to ground.

In the Auto mode, the output timer will not start timing until the Start input switch is opened. Therefore, it is normally recommended that remote Start and Stop input switches be momentary, rather than maintained.

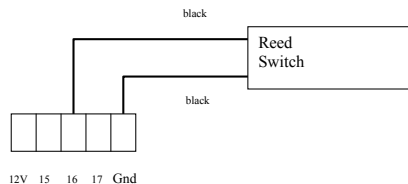
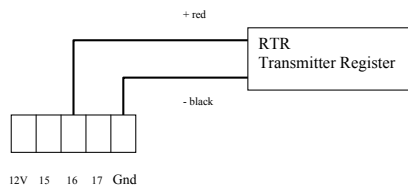
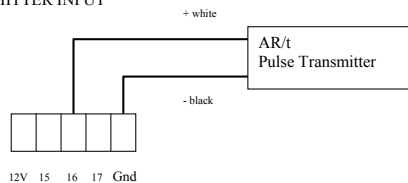
Lock inputs are treated as maintained inputs, and maintained switches should be used. Lockout occurs immediately when the lock input is active, and ends when the lock input goes inactive. There are several

variations of lock inputs. They are discussed in detail in the control input wiring section below. Since the power up start function will normally always be used or not used, use a jumper wire to enable power up start, or leave the terminal open to disable power up start.

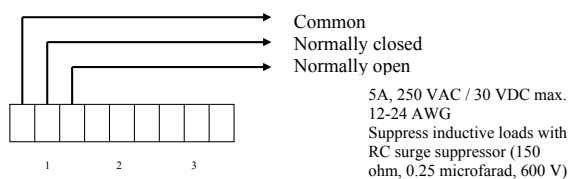
#### AC POWER INPUT



#### TRANSMITTER INPUT

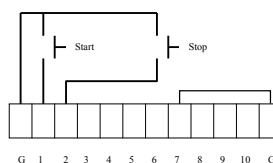


#### REGENERATION RELAY OUTPUT



#### CONTROL INPUTS

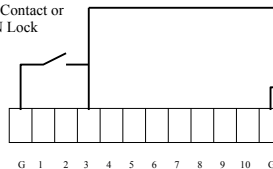
##### Start and Stop Inputs



All switch loads  
5VDC @ 1mA  
16-28 AWG  
terminal wiring.

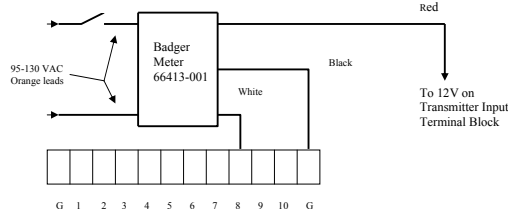
Power up start is active  
when input 7 is jumped  
to G.

##### Dry Contact or NPN Lock



Use either a mechanical  
switch, or an NPN transistor  
connected between input 3  
and either ground terminal.

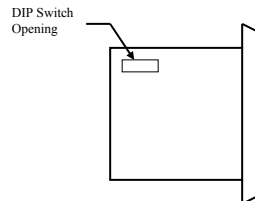
##### 115 VAC Lock



### CAUTION

Do not apply AC voltage directly to control inputs. Damage to the unit will result. Use a solid state input module (Badger Meter part 66413-001), or disconnect lock switch from AC, and wire directly across input 8 and ground.

#### DIP SWITCH



DIP Switch Settings  
(left to right)  
Down, Down, Up, Down, Down, Down

### PROGRAMMING

Installation programming requires setup of three parameters, mode (either Auto or Manual), 115 VAC lockout (either NO or NC), and flow transmitter pulse weight (either 1, 10 or 100 gallons per pulse). These settings are not normally changed after installation is completed, and are done on a display screen hidden from normal operator viewing. There are three other programmable settings normally made by the operator, batch size, auto mode timeout, and running batch count adjustment. These are described below in the run mode section.

The first time the controller is powered up after leaving the factory, the bottom line of the display will read "Enter Program Mode". Press the Run/Program key to put the unit into operation. The bottom line will then read "Start Stop." Also, when first powered up, the running count value will be zero. Set the count to any value other than zero, preferably to the batch size, before running the first batch. Once the first batch is run, the controller will automatically return to the batch preset value at the start of each new batch. To set the running count value, see the "Change Running Count Value" procedure in the run mode section.

To get to the installation programming screen, hold both the F1 and F6 keys down for three seconds. The display will then read:

Manual  
Lockout NO  
1 Pulse = 10 Gal.  
A/M Lock Pulse

A/M, Lock, and Pulse identify the three left-most unmarked keys below the display as programming keys. Pressing the A/M key toggles the mode between Auto and Manual. Pressing the Lock key toggles the 115 VAC lock input between Lockout NO and Lockout NC. If the 115 VAC lock switch is closed to lock the unit, and opened to unlock the unit, select Lockout NO. If the switch is opened to lock the unit, and closed to unlock it, select Lockout NC. If the 115 VAC lock input is not used, this selection must be Lockout NO.

Note that there are no choices to be made for the NPN/dry contact lock input (control input 3), whether it is used or not.

The Pulse key scrolls the transmitter pulse weight setting through three values, 1, 10, or 100 gallons per pulse. Select the setting which matches the transmitter output value from the tables below.

#### AR/t transmitter

Meter	Pulse Weight
RCDL models 25, 35, and 40	1 pulse = 1 gallon
RCDL models 70, 120, and 170	1 pulse = 10 gallons
Industrial Turbo 2", 3", and 4"	1 pulse = 10 gallons
Industrial Turbo 6"	1 pulse = 100 gallons

#### RTR transmitter / register

Meter	Pulse Weight
RCDL models 25, 35, 40, and 70	1 pulse = 1 gallon
RCDL models 120 and 170	1 pulse = 10 gallons
RCDL Turbo Series 1 ½" – 6"	1 pulse = 100 gallons

Once the mode, lockout, and pulse weight settings are set on the screen, press the View/Enter key to exit the program mode, and return to the run mode.

#### RUN MODE

When the Badger® PRC-20 controller is powered up, the display will normally show one of two screens. Pressing the View/Enter key will toggle the display between the screens. Screen 1 displays the running batch count on the top line, the batch preset on line 2, the time of day, day of week, and date on line 3, and the Start and Stop key identifiers on line 4. Screen 2 displays the timeout value for the auto mode regeneration timer. The running

batch count, batch preset, and timeout preset are operator editable, as explained below. Several operator prompt and status messages appear on lines 2 and 3 of screen 1. If the Start or Stop key is pressed, the word "Start?" or "Stop?" will flash on line 2 for up to ten seconds, prompting the operator to press the key again to complete the function. The status message "BATCH COMPLETE" will appear on line 3 whenever the regeneration output is on, and will turn off when the output turns off. Also on line 3, the status message "Lockout" will appear whenever a lock input is active.

Two other screens are available to the operator. One is used to adjust the running count value, and is described in "Change Running Count Value" below. The other displays a total flow count and instantaneous flow rate in gallons per minute. Press the F3 key to access this screen. After 20 seconds, it will automatically return to screen 1, or press the View/Enter key to go to screen 1 immediately. The total count value may be reset by pressing the F1 key. The date and time values may be edited on this screen by pressing the Edit, 0-9, and Enter keys. The day of week may be edited by pressing the Edit, up or down arrow, and Enter keys.

Other than observing values on the display, and controlling lockout conditions, there are five actions that may be expected of the operator in dealing with the PRC-20:

1. Manual regeneration cycle start
2. Manual regeneration cycle stop
3. Change batch preset value
4. Change timeout period
5. Change running count value

Detailed instructions for each action are given below.

#### MANUAL REGENERATION CYCLE START

The regeneration cycle will normally be started automatically when the batch counter counts down to zero. However, the cycle can be started manually in two ways. First, an external Start pushbutton may be connected to the controller. Pressing the button should cause the cycle to start. Second, pressing the front panel Start key twice will cause the cycle to start, if a lockout is not in progress. The Start key is the left-most unmarked button beneath the display. On screen 1, the word "Start" appears above it. When the Start key is pressed once, the message "Start?" will flash on line 2 of the display. If the Start key is pressed again, the regeneration cycle will begin. If the Start key is not pressed again within ten seconds, the flashing message will stop, and the controller's display will return to normal.

#### MANUAL REGENERATION CYCLE STOP

When a regeneration cycle has been started, the third line of the display on screen 1 will say "BATCH COMPLETE." If the controller is set in the Auto mode, the running count value will return to the batch preset value immediately, and will count down as flow continues. In the Auto mode, the regeneration cycle will end on its own, after a timeout period has elapsed. If the controller is set in the Manual mode, the running count will remain at zero, even as flow continues, and the regeneration cycle will not time out on its own, but will have to be manually stopped.

There are two ways to manually stop the regeneration cycle once it has been started. First, an external Stop push button may be connected to the controller. Pressing it should cause the cycle to end, which causes the running count to go to the batch preset value, and count down. Also, the "BATCH COMPLETE" status message will disappear from the display. Second, pressing the front panel Stop key twice will end the cycle. The Stop key is the second unmarked key from the left, below the display. When the Stop key is pressed, the message "Stop?" will appear on line 2 of the display. If the Stop key is pressed again, the cycle will end. If the Stop key is not pressed again within ten seconds, the flashing message will stop, the controller's display will return to normal, and the regeneration cycle will continue.

### **CHANGE BATCH PRESET VALUE**

The batch preset value appears on line 2 of display screen 1. It will be a six, seven, or eight digit number. Only the six most significant digits of this number are editable. Any remaining zeroes in the least significant place or places will always remain at zero. Press the Edit key. One of the digits on line 2 will be flashing. If any zeroes are to the right of the flashing digit, they cannot be changed, and the preset must be entered with those in mind. Use the 0-9 keys to edit the preset value, and then press the Enter key to store the new value.

#### **EXAMPLES:**

The present batch preset value appears on line 2 as 000750 gallons (six digits). Change this value to 780 gallons.

When the edit key is pressed the sixth digit from the left (0) will flash. Press keys 7, 8, and 0, and line 2 will read 000780, with the last digit still flashing. Press the Enter key and the new number (000780) will be stored and the flashing will stop.

The present batch preset value appears on line 2 as 0000750 gallons (seven digits).

Change this value to 780 gallons.

When the edit key is pressed, the sixth digit from the left (5) will flash. Press keys 7 and 8, and the line 2 number will read 0000780, with the "8" flashing. Press the Enter key and the new number 0000780 will be stored and the flashing will stop.

### **CHANGE TIMEOUT PERIOD**

Press the View/Enter key to put screen 2 on the display. Screen 2 will read:

Timeout  
0010 Sec.,  
(or some other value.)

Press the edit key. The least significant digit (in this case, a zero) will flash. Use the 0-9 keys to edit the timeout value on line 2. Press the Enter key to store the new value.

### **CHANGE RUNNING COUNT VALUE**

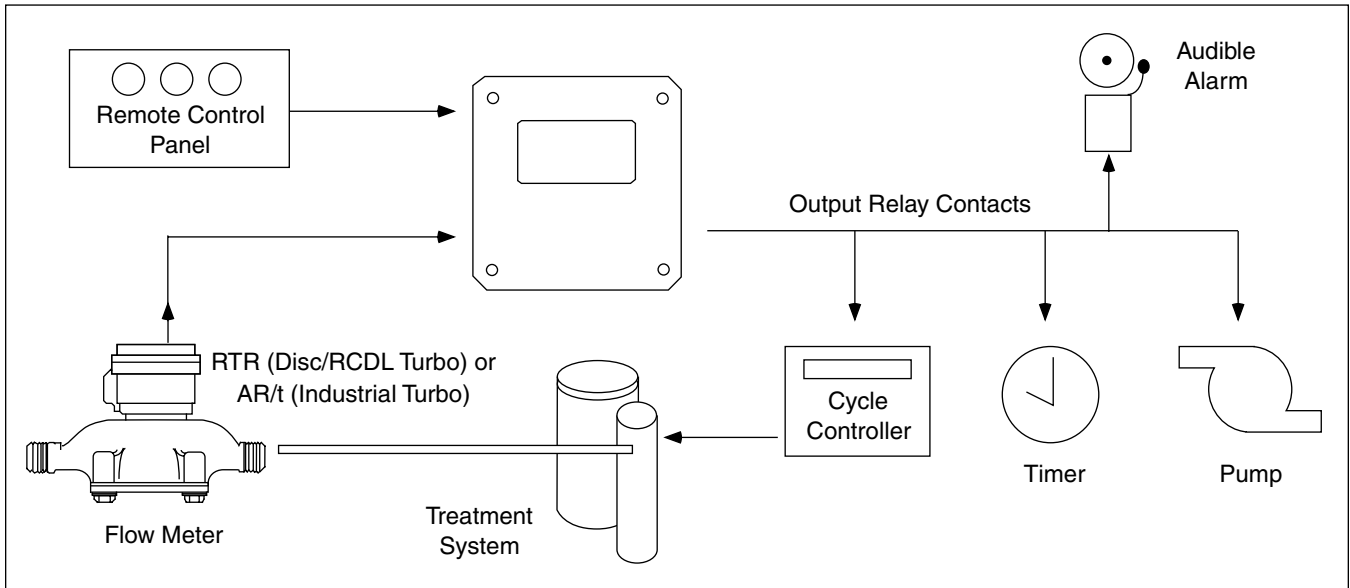
The running count is displayed on the top line of screen 1. It is a six digit count, which may have one or two zeroes attached to the right-hand side. Any leading zeroes on the left-hand side are deleted. It may be necessary for the operator to change the present value. First decide what new value the count should be. Then, with screen 1 being displayed, press the Reset key. The display will read:

Reset to  
0000010,  
(or some other value.)

Press the Edit key. The sixth digit from the left (in this case a "1") will flash. Use the 0-9 keys to edit the value, and then press Enter to store the value. To complete the process, press the Reset key again. The display will return to screen 1, and the running count will go to the new value. If the process is not completed in 20 seconds, the display will go back to screen 1 automatically.

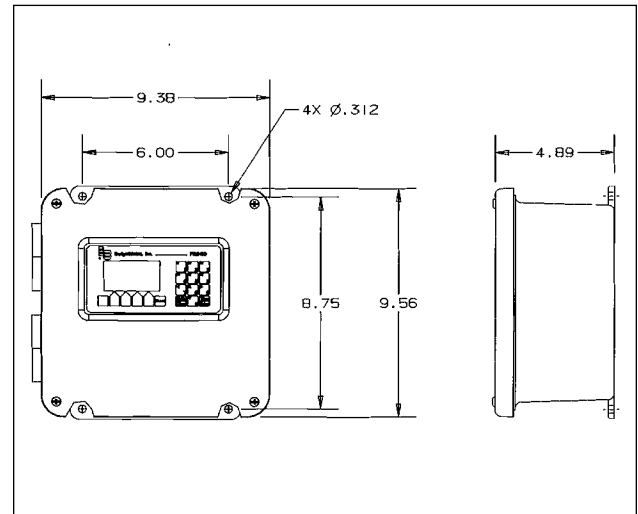
### **START-UP CHECKLIST**

1. If the bottom line of display reads "Enter program Mode," press the Run/Program key. Bottom line should read "Start Stop."
2. Access the programming screen and set up mode, lockout type, and pulse weight.
3. Set running batch count to first batch size.
4. Enter batch preset value.



## SPECIFICATIONS

<b>Power Input:</b>	85-265 VAC, 47-63 Hz.
<b>Signal Inputs:</b>	
* Transmitter Pulse Input:	Dry Switch Closure or Electronic Transmitter (Current Sinking)
* Lockout Signal Input:	Dry Switch Closure/Open Collector and 115 VAC (Optically-isolated)
* Remote START & STOP Input:	Dry Switch Closure/Open Collector (Optically-isolated)
<b>Output Signal:</b>	Form 'C' Contact, 250 VAC/30 VDC @ 0.5 amp, Resistive
<b>Operating Modes:</b>	Programmable
* Manual:	Reset & Start on command only
* Automatic:	Timed output signal and auto reset at end of batch
<b>Programmable Functions:</b>	
* Output signal duration:	1 to 9999 seconds (Auto Mode)
* Batch size:	Maximum of 99,999,900 gallons, depending on meter size
* 115 VAC lockout:	NO or NC Programmable



### Environmental:

- \* Operating Temperature: 32° to 122° F (0° to 50° C)
- \* Operating Humidity: Up to 85% non-condensing

**Display:** Four line alphanumeric LCD

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Badger® is a registered trademark of Badger Meter Inc.



Please see our website at  
[www.badgermeter.com](http://www.badgermeter.com)  
for specific contacts.

Due to continuous research, product improvements and enhancements, Badger Meter reserves the right to change product or system specifications without notice, except to the extent an outstanding contractual obligation exists.



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