Badger Meter

Industrial Controllers

Model PRC-20 Water Conditioning Controller

CTL-UM-00114-EN-03 (November 2015)

User Manual

CONTENTS

ABOUT THIS MANUAL

This manual describes how to install, operate and maintain the Badge Meter® Model PRC-20 Water Conditioning Controller. For proper performance of the system, understand and follow the instructions given in this manual.

SAFETY INFORMATION

The installation of the Model PRC-20 controller must comply with all applicable federal, state, and local rules, regulations and codes.

Failure to read and follow these instructions can lead to misapplication or misuse of the Model PRC-20 controller, resulting in personal injury and damage to equipment.

UNPACKING & INSPECTION

Upon opening the shipping container, 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 damage in transit is the sole responsibility of the purchaser.

INSTALLATION

The control system consists of a Badger Meter Disc or Turbo meter with the RTR® pulse transmitter and the Model PRC-20 Water Conditioning Controller. Normally, the transmitter is 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. The RTR dial face has the model designation of the appropriate meter.

OPERATION

The basic function of the Badger Meter 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 US 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 controller 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 immediately returns to the preset amount and counts down as pulses are received from the meter. Regeneration ends when the timeout period elapses, or when a *Stop* input occurs. In *Manual* mode, the count remains at zero, and regeneration continues 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 remembers 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 controllers 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 also stores the time remaining in the cycle. The unit stores these values in non-volatile memory, which requires no battery, and it retains these values.

When power to the control is turned back on, the unit either continues from where it left off when power was lost, or it automatically initiates a regeneration cycle. If the powerup *Start* input is disabled, the controller simply continues counting from the retained time value, and/or timing the regeneration cycle from the retained time value. If the powerup *Start* input is enabled, the controller starts 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 with adequate ventilation, protection against mechanical shock and accessibility for operation and service.

Operating Temperature: 32…122° F (0…50° C)

Operating Humidity: Up to 85% non-condensing

Wall or Panel Mount

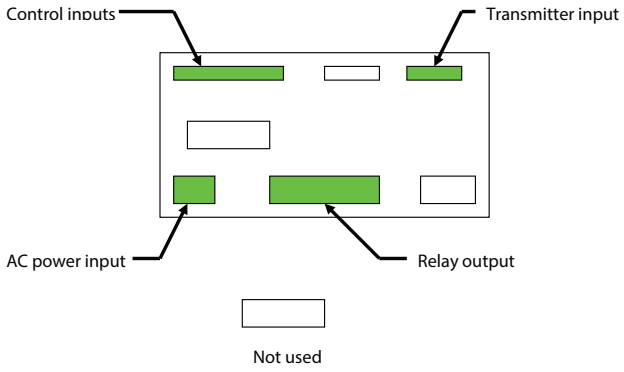
1. Using the appropriate mounting hardware, attach the back part of the housing to the mounting surface.
2. Wire the unit according to *"Wiring" on page 6*.

WIRING

There are seven terminal blocks on the rear of the PRC-20 controller. Three of them require wiring, one may require wiring, and three do not require any wires. To avoid damage to the controller, do not use any of the unused terminals in the following diagrams for wiring points. The three terminal blocks that require wiring are:

- AC power input
- Transmitter input
- Regeneration relay output

Terminal Block Layout



The control input terminal block requires wiring only if a remote *Start* or *Stop* input is used, if a lockout input is needed, or if powerup *Start* must be enabled.

The remote *Start* and *Stop* inputs duplicate the functions of the front panel *Start* and *Stop* buttons, with some differences.

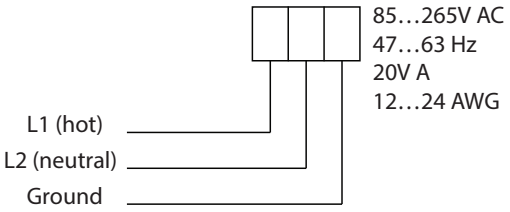
- The front panel *Start* and *Stop* buttons require a second press of the button within ten seconds of the first press to initiate a start or stop.
- The rear terminal *Start* and *Stop* inputs initiate the function immediately.
- The front panel *Start* and *Stop* buttons act as momentary switches, 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 turns on and remains on as long as the input is grounded. A *Stop* input always overrides a *Start* input, for as long as the *Stop* input is connected to ground.

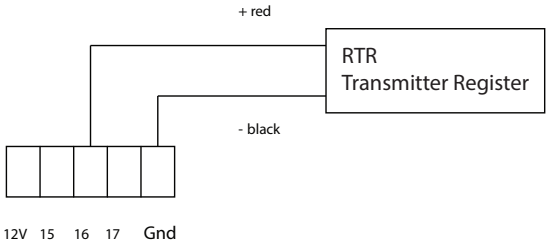
In the *Auto* mode, the output timer starts timing when the *Start* input switch is opened. Therefore, the remote *Start* and *Stop* input switches should be momentary, rather than maintained.

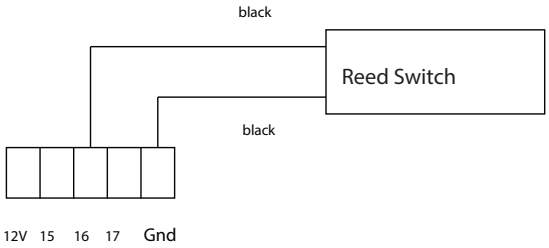
Lock inputs are treated as maintained inputs, and maintained switches should be used. Lockout occurs immediately when the lock input is active, and ends when the lock input goes inactive. There are several variations of lock inputs. They are described in detail in the control input wiring section below. Since the powerup *Start* function is normally *always* used or *always* not used, use a jumper wire to enable powerup *Start*, or leave the terminal open to disable powerup *Start*.

AC Power Input

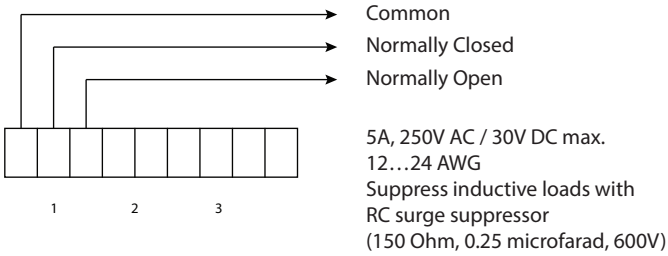


Transmitter Input





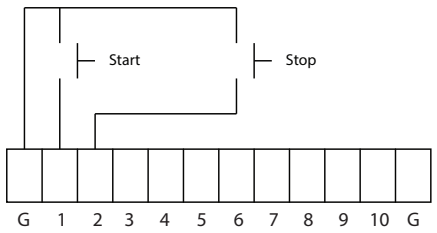
Regeneration Relay Output



5A, 250V AC / 30V DC max.
12…24 AWG
Suppress inductive loads with
RC surge suppressor
(150 Ohm, 0.25 microfarad, 600V)

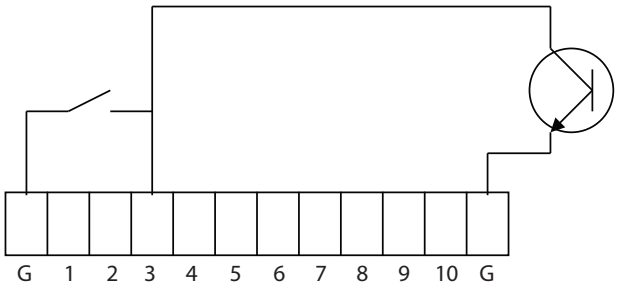
Control Inputs

Start and Stop Inputs



All switch loads
5V DC @ 1 mA
16…28 AWG
terminal wiring

Dry Contact or NPN Lock

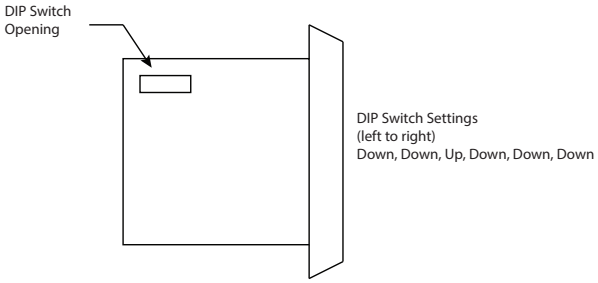


Use either a mechanical switch or an NPN transistor connected between input 3 and either ground terminal.

⚠CAUTION

DO NOT APPLY AC VOLTAGE DIRECTLY TO CONTROL INPUTS. DAMAGE TO THE UNIT WILL RESULT. USE A SOLID-STATE INPUT MODULE, OR DISCONNECT LOCK SWITCH FROM AC AND WIRE DIRECTLY ACROSS INPUT 8 AND GROUND.

DIP Switch Settings



PROGRAMMING

Installation programming requires the setup of three parameters:

- Mode (either *Auto* or *Manual*)
- 115V AC lockout (either NO or NC)
- Flow transmitter pulse weight (either 1, 10 or 100 US 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 operator-programmable settings (see *"" on page 9*):

- Batch size
- Auto mode timeout
- Running batch count adjustment

The first time the controller is powered up after leaving the factory, the bottom line of the display reads "Enter Program Mode". Press **Run/Program** to put the unit into operation. The bottom line then reads "Start Stop." Also, when first powered up, the running count value is 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 automatically returns to the batch preset value at the start of each new batch. To set the running count value, see *"Change Running Count Value" on page 11*.

To get to the installation programming screen, simultaneously hold down **F1** and **F6** for three seconds. The display then reads:

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.

- Press **A/M** to toggle between *Auto* mode and *Manual* mode.
- Press **Lock** to toggle the 115V AC lock input between *Lockout NO* and *Lockout NC*.
  - ◊ If the 115V AC 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 115V AC lock input is not used, select **Lockout NO**.

NOTE: There are options for the function of 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 US gallons per pulse. Select the setting that matches the transmitter output value from the following table.

RTR Transmitter / Register

Meter	Pulse Weight
RCDL models 25, 35, 40, and 70	1 pulse = 1 US gallon
RCDL models 120 and 170	1 pulse = 10 US gallons
RCDL Turbo Series 1-1/2…20 in.	1 pulse = 100 US gallons

Once the mode, lockout, and pulse weight settings are set on the screen, press **View/Enter** to exit the *Program* mode and return to the *Run* mode.

Run Mode

Screens

When the PRC-20 controller is powered up, the display shows one of two screens. Pressing **View/Enter** toggles 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.

Two other screens are available.

- One screen is used to adjust the running count value, and is described in *"Change Running Count Value" on page 11*.
- The other screen displays a total flow count and instantaneous flow rate in US gallons per minute. Press **F3** to access this screen. After 20 seconds, it automatically returns to *Screen 1*, or press **View/Enter** to go to *Screen 1* immediately.
  - ◊ Press **F1** to reset the total count value.
  - ◊ Press **Edit**, **0…9**, and **Enter** to edit the date and time value.
  - ◊ Press **Edit**, **up** or **down arrow**, and **Enter** to edit the day of the week.

Prompts and Messages

Several operator prompt and status messages appear on lines 2 and 3 of *Screen 1*.

- When you press **Start** or **Stop**, the word "Start?" or "Stop?" flashes on line 2 for up to ten seconds, prompting you to press the key again to complete the function.
- The status message "Batch Complete" appears on line 3 whenever the regeneration output is on. The "Batch Complete" message turns off when the output turns off.
- The status message "Lockout" appears on line whenever a lock input is active.

Manual Mode

Operator Actions

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:

- Manual regeneration cycle *Start*
- Manual regeneration cycle *Stop*
- Change batch preset value
- Change timeout period
- Change running count value

Manual Regeneration Cycle Start

The regeneration cycle starts automatically when the batch counter counts down to zero. However, the cycle can be started manually in two ways.

- An external **Start** pushbutton may be connected to the controller. Press the external pushbutton to start the cycle.

  OR

- Press the front panel **Start** key twice to start the cycle, if a lockout is not in progress. *Start* is the left-most unmarked button beneath the display. On *Screen 1*, the word "Start" appears above it. Press **Start** once and the message "Start?" flashes on line 2 of the display. Press **Start** again to begin the regeneration cycle. If *Start* is not pressed again within ten seconds, the flashing message stops and the display returns to normal.

Manual Regeneration Cycle Stop

When a regeneration cycle has been started, the third line of the display on *Screen 1* says "Batch Complete." If the controller is set in the *Auto* mode, the running count value returns to the batch preset value immediately, and counts down as flow continues. In the *Auto* mode, the regeneration cycle ends on its own, after a timeout period has elapsed. If the controller is set in the *Manual* mode, the running count remains at zero, even as flow continues, and the regeneration cycle does not time out on its own, but has to be manually stopped.

There are two ways to manually stop the regeneration cycle once it has been started.

- An external **Stop** pushbutton may be connected to the controller. Press the external pushbutton to end the cycle. The running count goes to the batch preset value and counts down. Also, the "Batch Complete" status message disappears from the display.

  OR

- Press the front panel **Stop** key twice to 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?" appears on line 2 of the display. If the *Stop* key is pressed again, the cycle ends. If the *Stop* key is not pressed again within ten seconds, the flashing message stops, the display returns to normal, and the regeneration cycle continues.

Change Batch Preset Value

The batch preset value appears on line 2 of display *Screen 1*. It is 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 always remain at zero.

1. With *Screen 1* displayed, press **Edit**.
   One of the digits on line 2 flashes. 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.
2. Use the 0…9 keys to edit the preset value.
3. Press **Enter** to store the new value.

Examples

The present batch preset value appears on line 2 as 000750 US gallons (six digits). Change this value to 780 US gallons.	1. Press **Edit**. The sixth digit from the left (0) flashes. 2. Press **7**, **8**, and **0**. Line 2 shows 000780, with the last digit still flashing. 3. Press **Enter** to store the new number (000780). The flashing stops.
The present batch preset value appears on line 2 as 0000750 US gallons (seven digits). Change this value to 780 US gallons.	1. Press **Edit**. The sixth digit from the left (5) flashes. 2. Press **7** and **8**. Line 2 shows 0000780, with the last digit still flashing. 3. Press **Enter** to store the new number (0000780). The flashing stops.

Change Timeout Period

1. Press **View/Enter** to put *Screen 2* on the display. *Screen 2* reads: "Timeout 0010 Sec.,"(or some other value).
2. Press **Edit**. The least significant digit (in this case, a zero) flashes.
3. Use the 0…9 keys to edit the timeout value on line 2.
4. Press **Enter** to store the new value.

Change Running Count Value

The running count displays on the top line of *Screen 1*. It is a six-digit count, which may have one or two zeroes attached to the right side. Any leading zeroes on the left side are deleted. It may be necessary to change the present value.

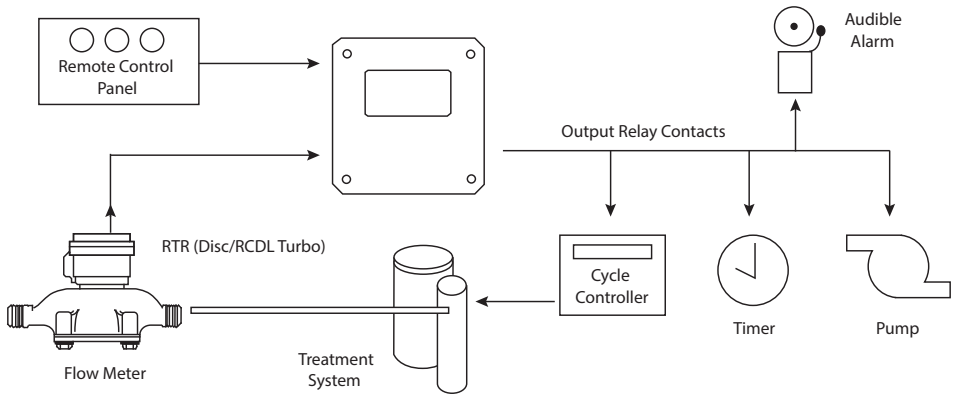
1. Decide what new value the count should be.
2. With *Screen 1* displayed, press **Reset**. The display reads: "Reset to 0000010," (or some other value)
3. Press **Edit**. The sixth digit from the left (in this case a "1") flashes.
4. Use the 0…9 keys to edit the value and press **Enter** to store the value.
5. Press **Reset** again.

The display returns to *Screen 1*, and the running count goes to the new value. If the process is not completed in 20 seconds, the display automatically returns to *Screen 1*.

STARTUP CHECKLIST

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

APPLICATION SCHEME



SPECIFICATIONS

Power Input	85…265V AC, 47…63 Hz	
Signal Inputs	Transmitter Pulse Input	Dry switch closure or electronic transmitter (current sinking)
	Lockout Signal Input	Dry switch closure/open collector and 115V AC (optically isolated)
	Remote Start and Stop Input	Dry switch closure/open collector (optically isolated)
Output Signal	Form C Contact 250V AC / 30V DC @ 0.5 amp, resistive	
Operating Modes	Programmable	
	Manual	Reset and start on command only
	Automatic	Timed output signal and auto reset at end of batch
Programmable Functions	Output Signal Duration	1…9999 seconds (auto mode)
	Batch Size	Maximum of 99,999,900 gallons, depending on meter size
	115V AC Lockout	NO or NC programmable
Environmental	Operating Temperature	32…122° F (0…50° C)
	Operating Humidity	Up to 85% non-condensing
Display	4-line alphanumeric, LCD	

Control. Manage. Optimize.

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