CV-230 Control Valve

Instruction Manual

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CV-230 Rev. 12/14/2022

Hydro Instruments
Series CV-230 Control Valve

Table of Contents

I. GENERAL SAFETY AND OVERVIEW

1. SAFETY PRECAUTIONS

GENERAL: Be sure to follow all applicable and prudent safety precautions when working with chemicals and electrical equipment. Chlorine is a dangerous chemical, be sure to check the MSDS safety data for chlorine before starting.

ELECTRICAL: The circuit board and incoming A/C power line do include electrical shock risk. Take care to avoid electrical shocks and do not touch any part of the circuit board or A/C power line unless you are certain that A/C power has been disconnected from the system.

CHECK FOR DAMAGE: Before removing the product from the shipping packaging, carefully check the equipment for damage. If any product is found damaged, do not put it into operation or install it. Contact Hydro Instruments to discuss repair or replacement of the damaged equipment.

2. OVERVIEW

The basic function of the CV-230 Control Valve is to automatically control chemical feed rate based an electrical input signal. Using a v-notch stem and a linear drive stepper motor, the CV-230 control valve provides precise and repeatable feed rate control with minimal wear and tear. The CV-230 is the combination of a microprocessor and a control valve in one compact design. Both the microprocessor and the valve motor assembly are housed together in one NEMA 4X rated enclosure. The valve body is mounted onto the bottom face of the enclosure. This body is constructed from solid machined PVC parts and is available in different sizes. Valve bodies, stems, seats and O-ring materials are of maximum corrosion resistances. Two PTFE shaft seals separate the chemical from the interior of the enclosure. There is also a vent port to the outside in between the two shaft seals for additional protection against chemical entry to the enclosure. A variety of valve stems, seats and bodies are available to accommodate different chemical feed rates.

Keypad Operation: The keypad is used for navigating the display screen and setting parameters for the unit. Generally they are used as described below.

⬆ and ⬇: The ⬆ and ⬇ keys are used to cycle through the display screens.

⊕ and ⊖: The ⊕ and ⊖ keys are used to adjust the settings and values of a given parameter.

Physical Installation: The Control Valve must be mounted in the chemical feed line downstream from a chemical flow meter and upstream from the feed point (i.e. ejector, vacuum pump or check valve diffuser). See Figure 2.

NOTE: If the automatic valve is being used for liquid chemical feed such as sodium hypochlorite, having the chemical physically higher than the valve will create a hydrostatic pressure which could cause failure of the valves internal seals.

Chemical Types and Ranges: For gaseous chemical feed applications, the CV-230 control valve is most commonly used for chlorine, sulfur dioxide, ammonia, and carbon dioxide. For liquid chemical feed applications, the CV-230 is commonly used for sodium hypochlorite, hydrochloric acid, sodium bisulfite, sodium bisulfate, sodium chlorite, and aqueous ammonia solutions. Consult Hydro Instruments for usage in other chemical applications and for available feed rate ranges.

Electrical Inputs: The CV-230 offers one (1) 4-20mA analog input. The PV1 input channel is used only for Flow (or proportional) signal.

Electrical Outputs: The CV-230 has two outputs as described below.

Alarm Contact Output: The CV-230 includes one (1) SPDT alarm relay.

4-20mA Output: The CV-230 includes one (1) 4-20mA output representing the valve position.

FIGURE 1

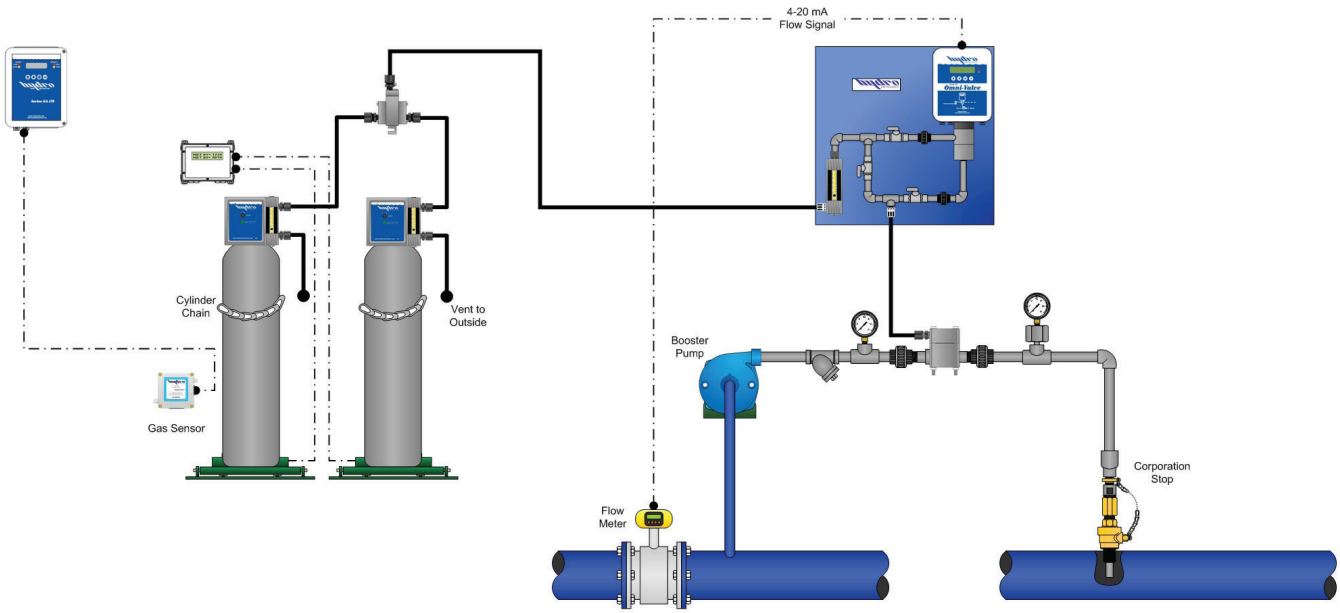
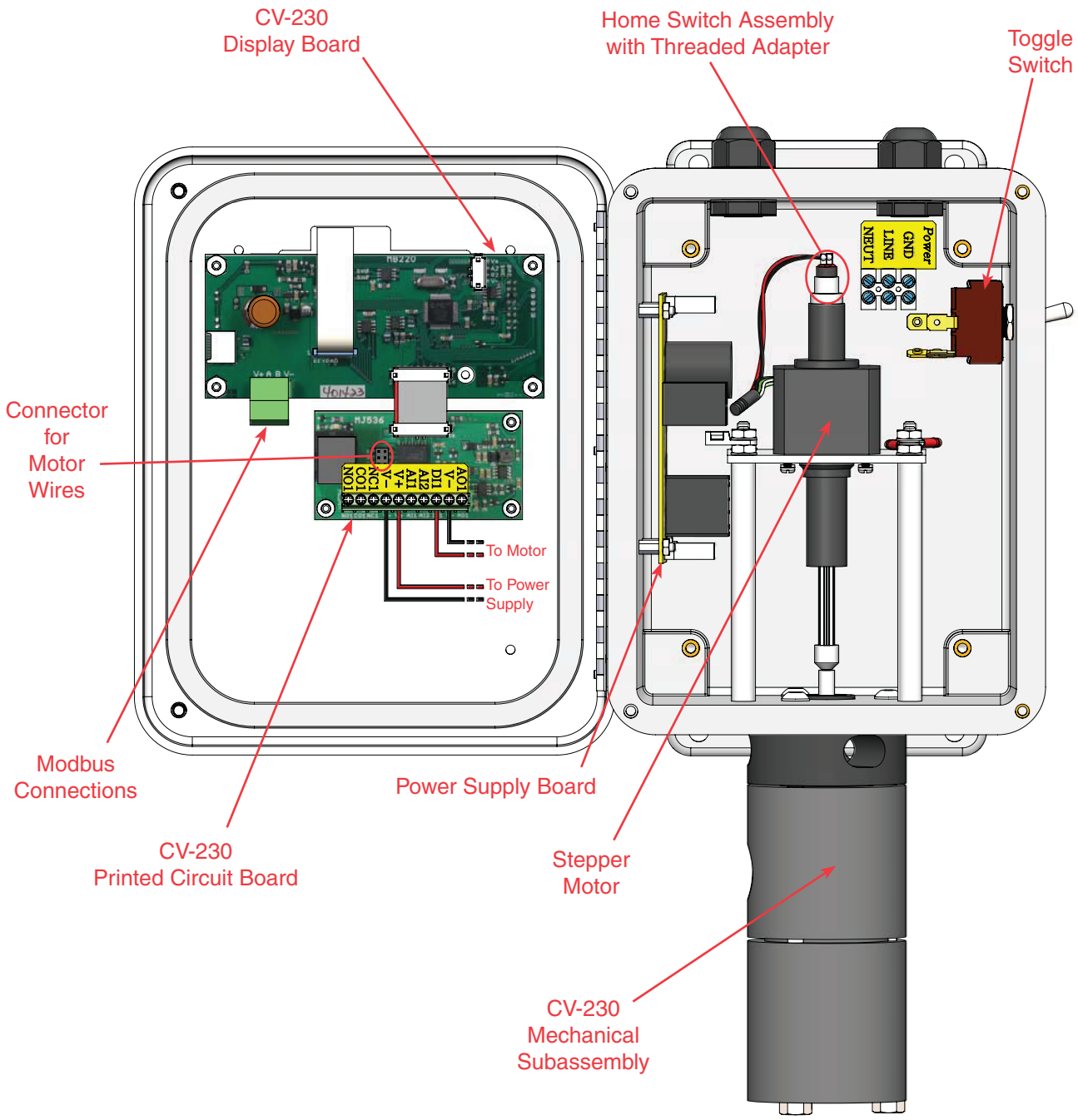


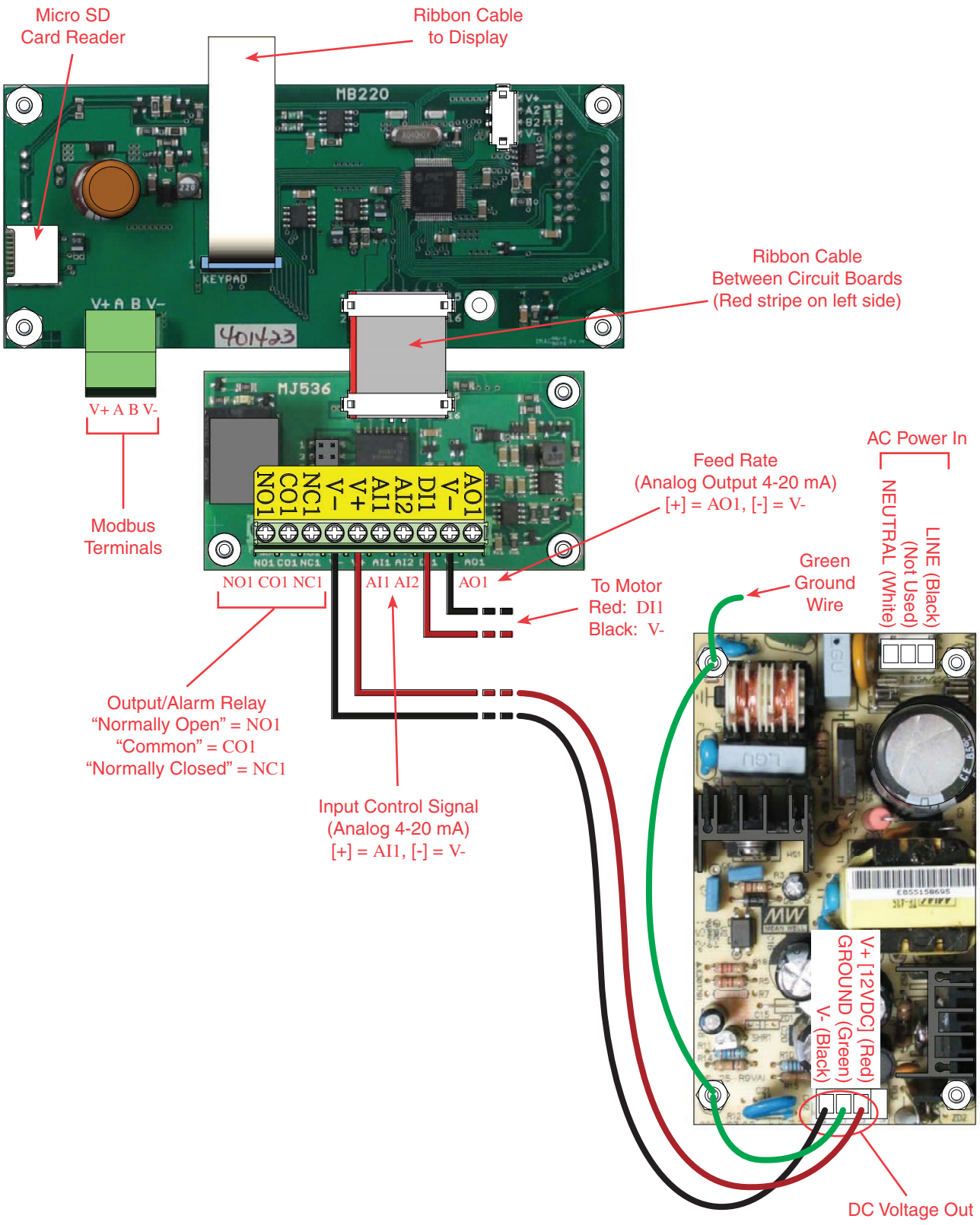
FIGURE 2 (CV-230 Controller Electronics)



CV-230 CONTROLLER ELECTRONICS

Date: 2019-02-06-v1
Dwg. No. CV-230-CONTROLLER

FIGURE 3



Date: June 2017
CV-230 CONTROLLER CIRCUIT BOARDS
Dwg. No. CV-230-PCBS

II. CONTROL METHOD

The CV-230 control valve uses flow pacing (proportional) control for superior accuracy and repeatability.

Application: This control method is suitable when water quality is consistent, but water flow rate is variable.

Control Concept: Chemical feed rate is adjusted in direct proportion to the input signal with no delay.

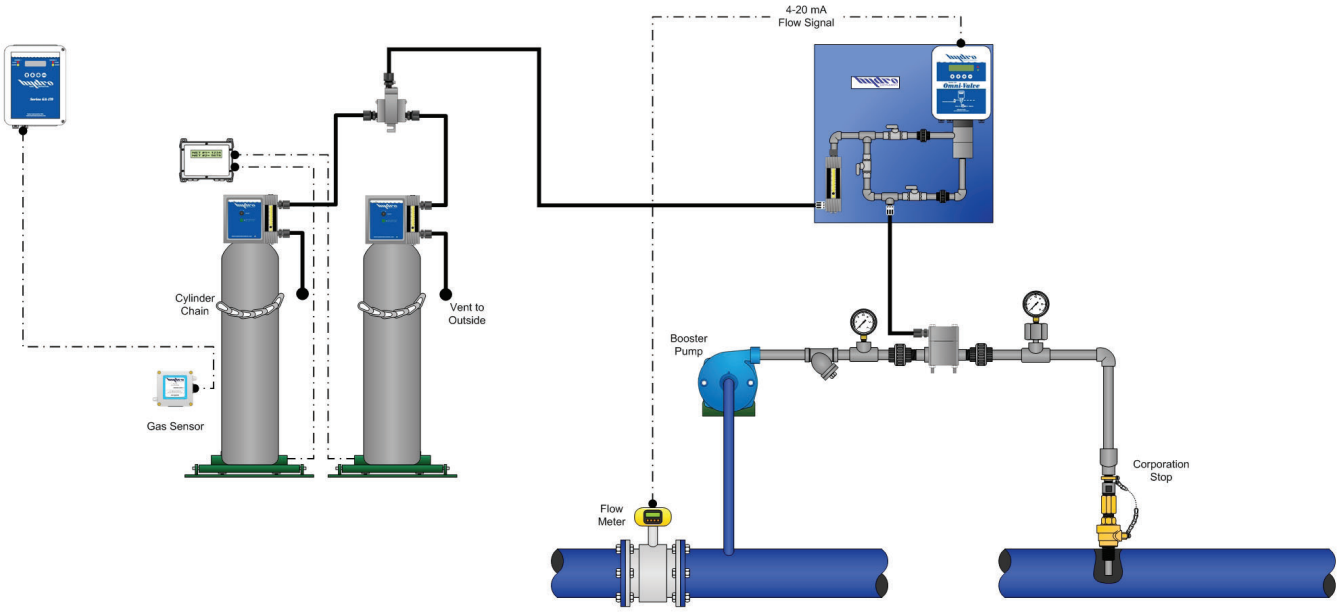
Control Signals: In this case, a 4-20mA signal from the water flow meter (measuring water flow just upstream from the injection point) is input to the AI1 and V- terminals of the CV-230.

NOTE: If desired, a proportional 4-20mA control signal from any PLC can be used in the same fashion.

Initial Settings: In the Configuration Mode (see Section III, page 8), the flow settings will need to be adjusted to match the water flow meter being used.

User Interaction: During operation, the user only needs to adjust the dosage setting to adjust the ratio of chemical feed rate to water flow rate.

FIGURE 4 (Flow Pacing)



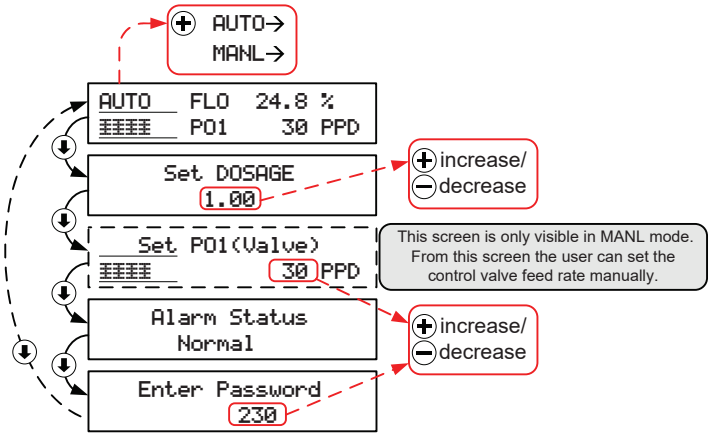
III. TYPES OF MODES

The CV-230 has three types of modes: operating mode, configuration mode, and advanced calibration mode. All of these modes can be accessed using the ⬆ and ⬇ arrows on the control panel. The configuration mode and the advanced calibration mode are password protected, and that password is 230 (the model number of the machine). Each mode has unique parameters to set the control valve which will be explained in this section.

1. Operating Mode

The operating mode is the first mode to appear when the unit turns on and should be the mode
used when this unit is in operation. A list of parameters this mode uses can be seen below figure 5. The parameters can be cycled through by using the ⬆ and ⬇ keys, and entered using the ⊕ and ⊖ keys.

FIGURE 5 (Operation Mode)

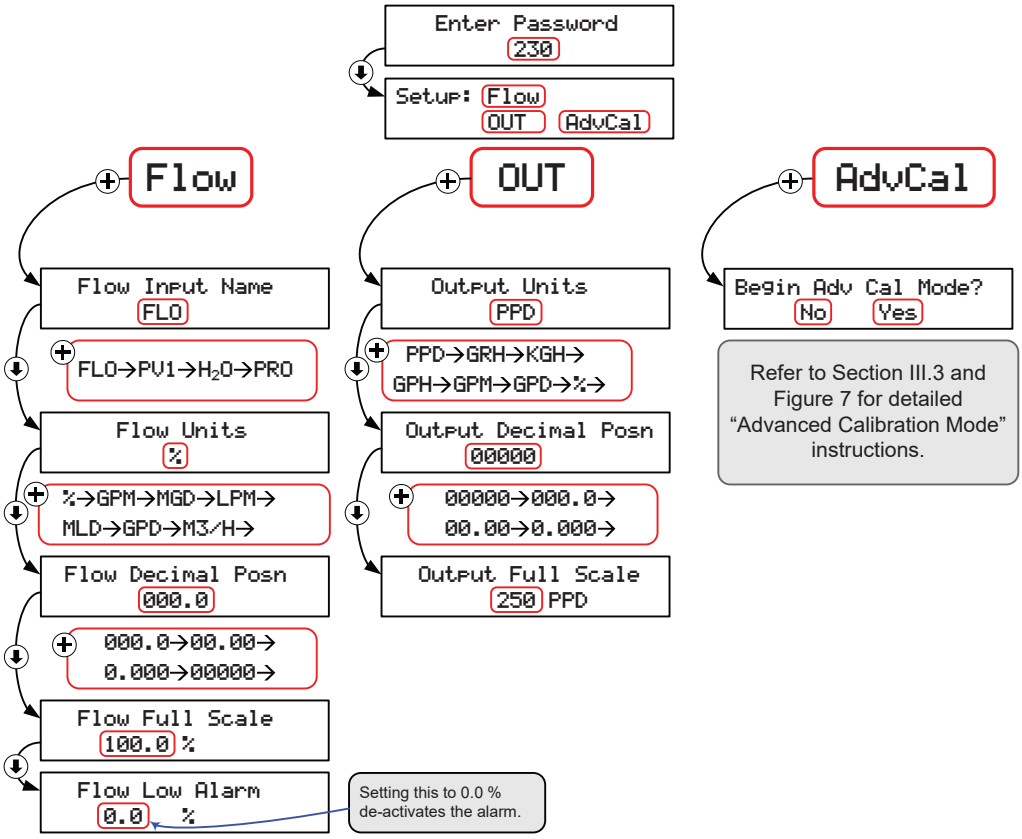


Automatic/Manual Control: When in the operating mode, the operator can decide to switch between automatic and manual flow control. When in screen 1 (Figure 5) press the ⊕ key once and in the upper left hand corner of the screen the display should switch from AUTO to MANL. The feed rate can then be adjusted on screen 3 using the ⊕ and ⊖ keys

2. Configuration Mode

The configuration mode can be reached from the operating mode screen by pressing the ⬇ key until the password screen appears. Enter “230” as the password by holding in the ⊕ key, followed by the ⬇ key again and the first parameter will appear. A list of the parameters can be seen below figure 6. The parameters can be cycled through by using the ⬆ and ⬇ keys, and entered using the ⊕ and ⊖ keys.

FIGURE 6 (Configuration Menus from Password 230)



3. Advanced Calibration Mode

The advanced calibration mode is the third mode in the CV-230. It utilizes a ten point linearization to memorize the unit's feed rate as a function of motor position. A more detailed description of the linearization can be found in Section IV. The parameters can be cycled through by using the ⇧ and ⇩ keys, and entered using the ⊕ and ⊖ keys.

NOTE: Do not enter screens 2 and 3 unless it is necessary to calibrate the FLO input.

Purge (For Liquid Feed Systems): The "purge" software is designed for use in liquid-feed applications where clogging of the control orifice is a concern. The software allows for periodic opening of the valve (fully open) in order to purge or flush the feed lines. The software allows for adjustment to the frequency of the purge function as well as adjustment to the length of each purge period.

NOTE: This feature is only included on valves shipped from Hydro Instruments after January 1, 2008.

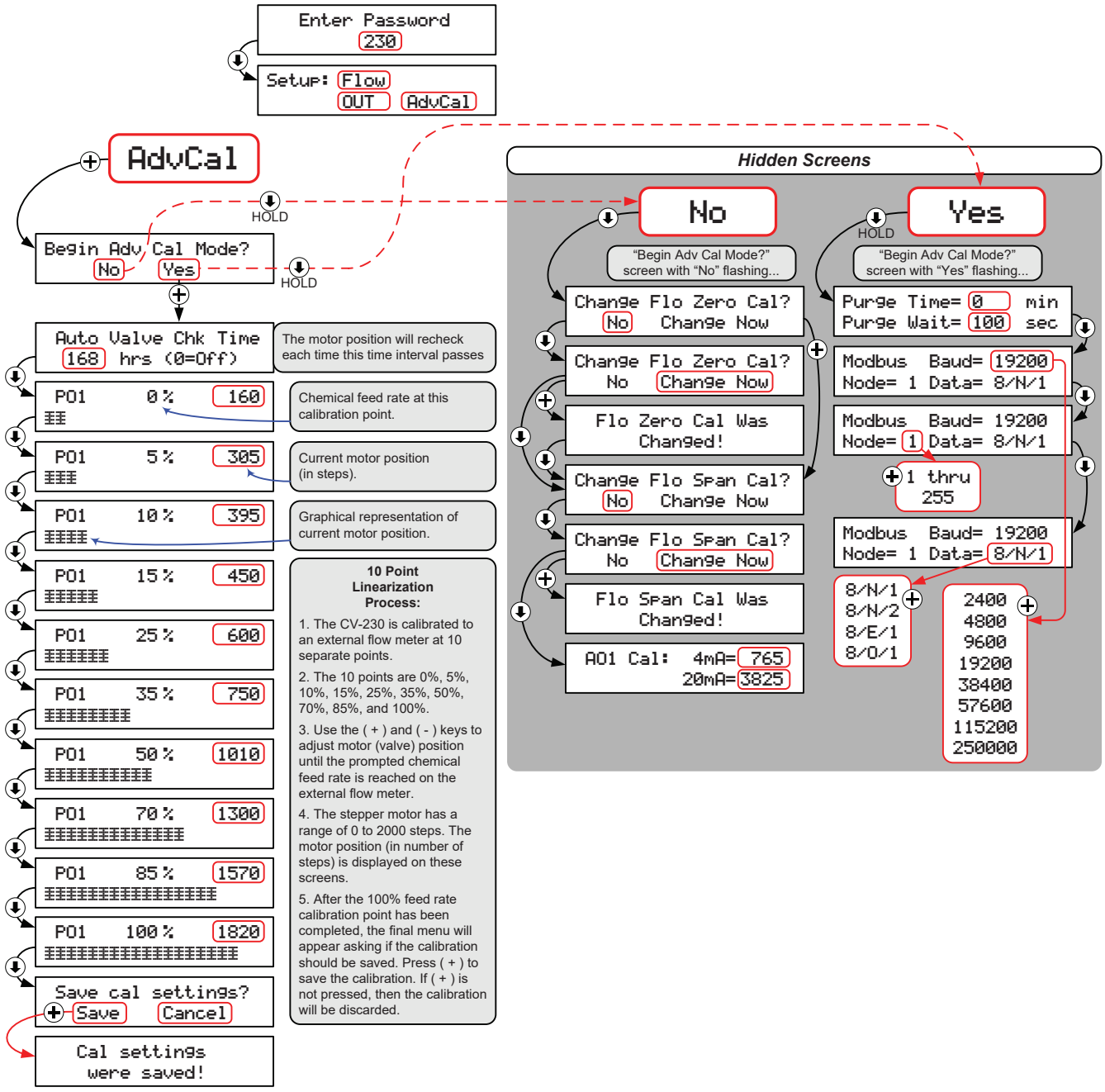
How to access and use this feature: See Figure 7.

Setting up the Purge feature:

1. The top line is the "time" setting and the number shown represents the number of minutes between each purge (a setting of 60 means the valve will purge every 60 minutes or 1 hour).
2. The bottom line is the "wait" setting and the number shown represents the number of seconds the valve will remain fully open during each purge (a setting of 15 means each purge will last 15 seconds).
3. Setting the Purge "time" to zero minutes (0) will disable this feature.

   NOTE: There will be some additional time during each purge when the valve is in the process of opening or returning from fully open to the previous feed rate.

FIGURE 7 (Advanced Calibration and Hidden Screens)



IV. MOTION CONTROL, VALVE, AND 10 POINT LINEARIZATION

The CV-230 uses a linear stepper motor for valve stem motion control. The motor shaft is directly coupled to the v-notch valve stem so that chemical feed can increase proportionally with motor travel. The motor covers its range of motion in 2000 steps. The motor position over the range can also be described in terms of motor steps where a position of 0 steps is the fully closed position and a position of 2000 linear steps is the fully open position. In a given system, each motor position will correspond to a chemical feed rate. For example motor position 215 might correspond to zero chemical feed and motor position 1925 might correspond to the maximum chemical feed rate. There is a calibration procedure that must be carried out with an external chemical flow meter in order to calibrate each CV-230 Control Valve in each installation (calibrate the motor position vs. chemical flow meter feed rate).

Procedure: The calibration procedure is performed simply by using the keypad and a chemical flow meter. To start navigate through the advanced calibration screens (see page 10) until screen 8a appears
(See Figure 7). The start point will be the zero feed rate. Press the ⊕ key until you see the chemical flow meter indicate feed and then press the ⊖ key until the flow meter first reaches zero. This will be your first calibration point. Press the ⬇ key and a new flow rate will appear at the center of the screen, use the ⊕ and ⊖ keys again until the new flow rate is reached. Repeat this process for all ten points.

NOTE: The motor steps are indicated in the upper right corner of the screen. At no point should a subsequent linearization point's motor steps be lower than the previous one. This will result in a bad linearization. For example: should 50 PPD = 952 steps the subsequent linearization point(s) cannot be lower than 952 steps.

FIGURE 8

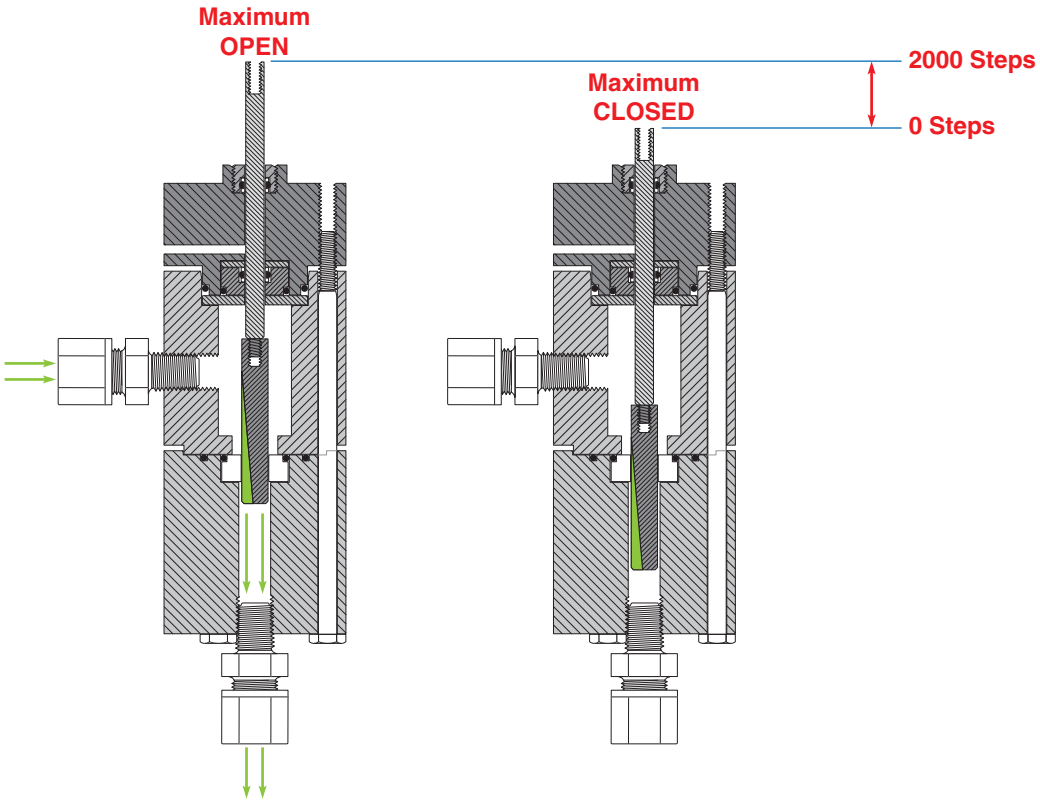
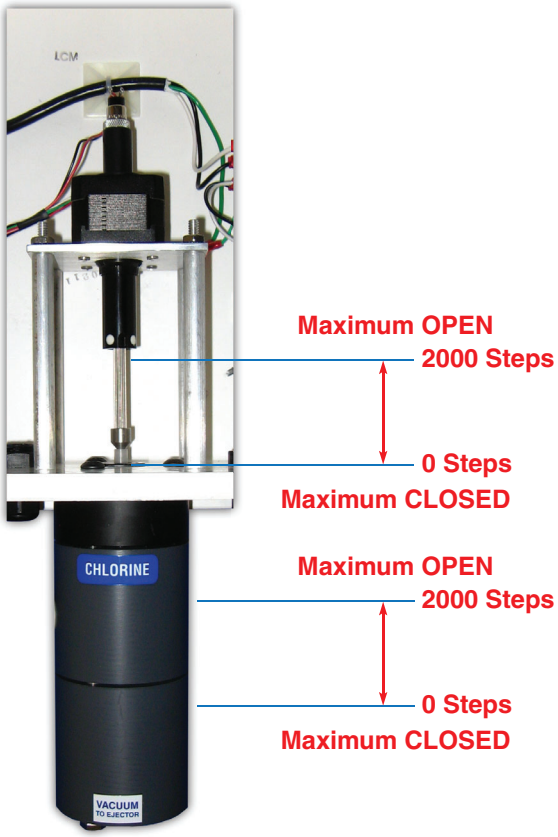


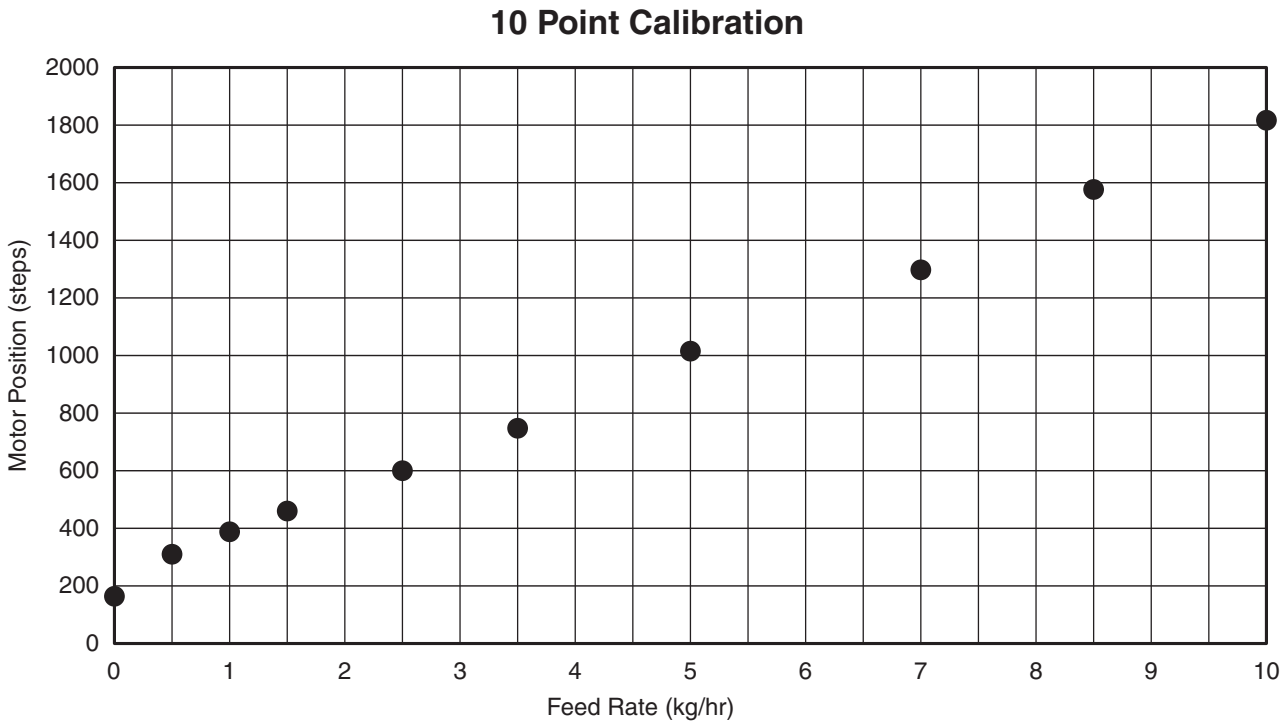
FIGURE 9



Feed Rate %	Feed Rate kg/hr	Motor Position Steps
0%	0	160
5%	0.5	305
10%	1	395
15%	1.5	450
25%	2.5	600
35%	3.5	750
50%	5	1010
70%	7	1300
85%	8.5	1570
100%	10	1820

NOTE: the feed rate and motor steps are variable based on the stem selected, however the percentages will always be the same.

FIGURE 10



V. REFERENCE TERMS AND PARAMETERS

Auto Valve Check Time: The auto valve check time is the time that the CV-230 operates before recalibrating itself. Recalibration is important for ensuring accurate chemical feed rate amounts and Hydro Instruments recommends this time be set to 168 hours.

Dosage: In the context of flow control dosage, this is a factor that is multiplied to the incoming flow signal. For example, if the incoming flow signal is at 50% (12mA) and the dosage is set to 2.0 then the CV-230 will adjust the chemical feed to 100% or in the same example, if the dosage is set to 0.5 the CV-230 will adjust the feed to 25%.

PO1: The symbol PO1 represents the flow rate of the chlorine or the injected chemical.

PV1: The symbol PV1 represents the water flow rate of the pipe line to be injected with the stored chemical.

VI. TROUBLESHOOTING AND MAINTENANCE

Factory Default: If there is an electronics problem that cannot be solved by any of the below efforts, then you might consider performing a factory default. However, when this is done all calibration data is lost and must be reset. Therefore it is best to try other steps first because you will have to go through both the Advance Calibration Mode and the Configuration Mode to enter all control and calibration settings. The factory default can eliminate glitches that may arise in the software by erasing all settings and entering the factory default settings. In order to perform a factory default follow these steps:

1. Turn off the power to the CV-230.
2. Hold both the ⬆ key and the ⬇ key on the front panel.
3. While holding both keys, turn on the power to the CV-230.

   SAFETY NOTE: Be sure to follow all safety precautions before attempting to service the CV-230
   Control Valve. Be sure to disconnect power from the CV-230 Control Valve before servicing electronics.

Servicing the Valve Body: (See Figures 11 and 12) if the valve becomes difficult to move or for the purpose of preventative maintenance (recommended every 12 to 24 months) the valve body should be serviced according to the following procedure:

1. **Removal of the valve body from the monitor enclosure:**
   a. Remove the three bolts at the bottom end of the valve body.
   b. Remove the Lower Body and Middle Body parts of the valve body assembly.
   c. Unscrew the Valve Stem and intermediate Valve Stem from the motor shaft. Avoid using pliers or any tool that will scar the surface of these parts.
   d. Unscrew and remove the three bolts inside the enclosure that hold the Upper Body to the enclosure.

2. **Top Shaft Seal:** Also remove the OV2-33 Seal Cap from the top of the Upper Body using a spanner wrench. There is a 3RS-108 O-Ring and Teflon seal under this part. When

reinstalling the OV2-33 Seal Cap do not over tighten. Use 7-10 inch-pounds torque.

3. **Maintenance:** All parts should be inspected for damage, cleaned, and lubricated* before reassembly. Generally, O-Rings should be replaced if in use for more than 12 months. The Valve Seat may require replacement if there are any cuts or burrs noticed. Hydro recommends replacement of AV2-62 during valve servicing.

   * Use appropriate lubrication for your chemical application. Contact your local representative of Hydro Instruments if there is any uncertainty.

4. **Reinstallation: IMPORTANT** – It is critically important that the threads on the Valve Stem and Intermediate Valve Stem be securely tightened during installation. Follow this procedure:

   a. Install all O-rings, Teflon Seals, Seal Cap and Stem Seal parts into the Upper body first. Then slip the Intermediate Valve Stem through the assembly.

   b. Secure the Upper Body to the enclosure being sure to use a new gasket between the two parts.

   c. Thread the Intermediate Valve Stem hand tight onto the motor shaft threaded adapter. Avoid using pliers or any tool that will scar the surface of the stem.

   d. Thread the Valve Stem hand tight onto the Intermediate Valve Stem. Avoid using pliers or any tool that will scar the surface of the stem.

   e. Install the Middle Body and Lower Body being sure not to move them in a way that would possibly unthread the Intermediate Valve Stem or the Valve Stem threads.

      NOTE: The bolts used to secure the valve body (3 bottom + 3 top) should be tightened to 20-25 inchpounds torque.

If you have any other troubleshooting questions contact us through our website www.hydroinstruments.com

VII. APPENDIX

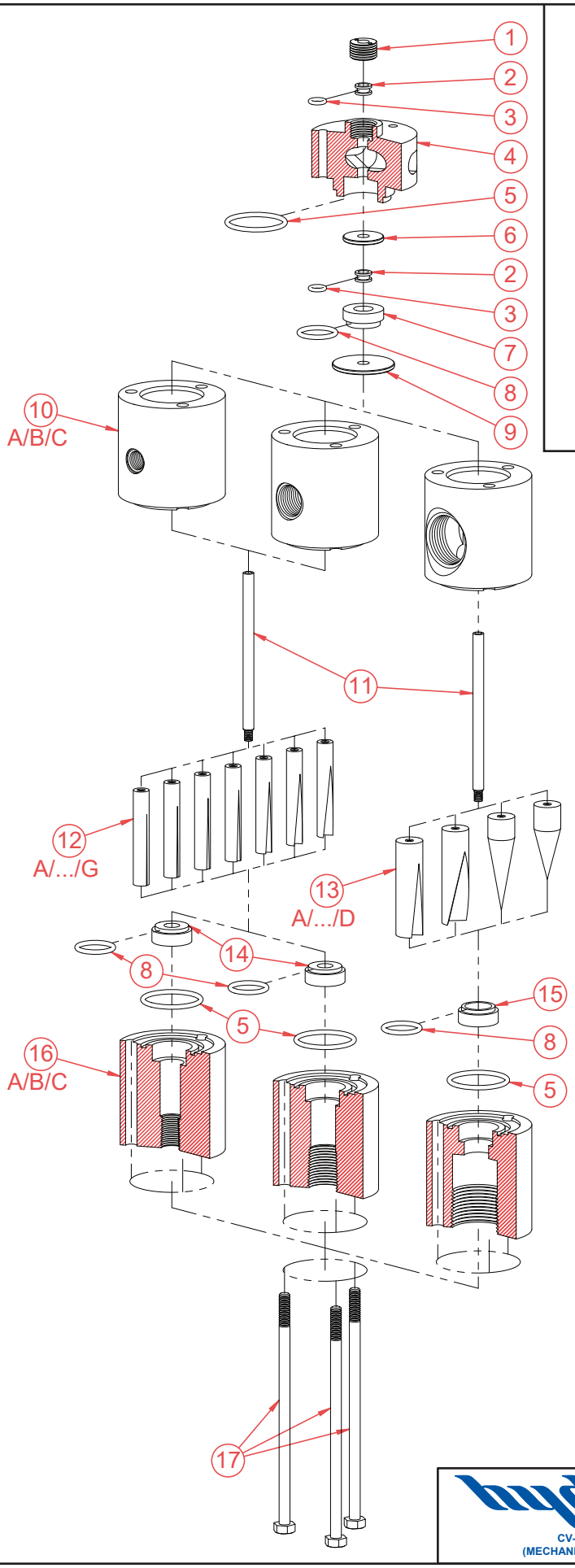
Flow Rate Units:

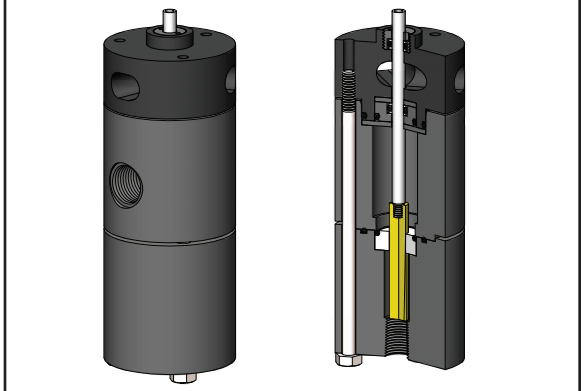
%	The flow is expressed as a percentage on the solution flow rate
GPM	Gallons per minute
MGD	Millions of gallons per day
LPM	Liters per minute
MLD	Millions of Liters per day
GPD	Gallons per Day
M^3/hr	Cubic Meters per Hour

Useful conversions:

1 Liter = .264 US Gallons = .001 M3

1 Day = 24 hours = 1440 minutes



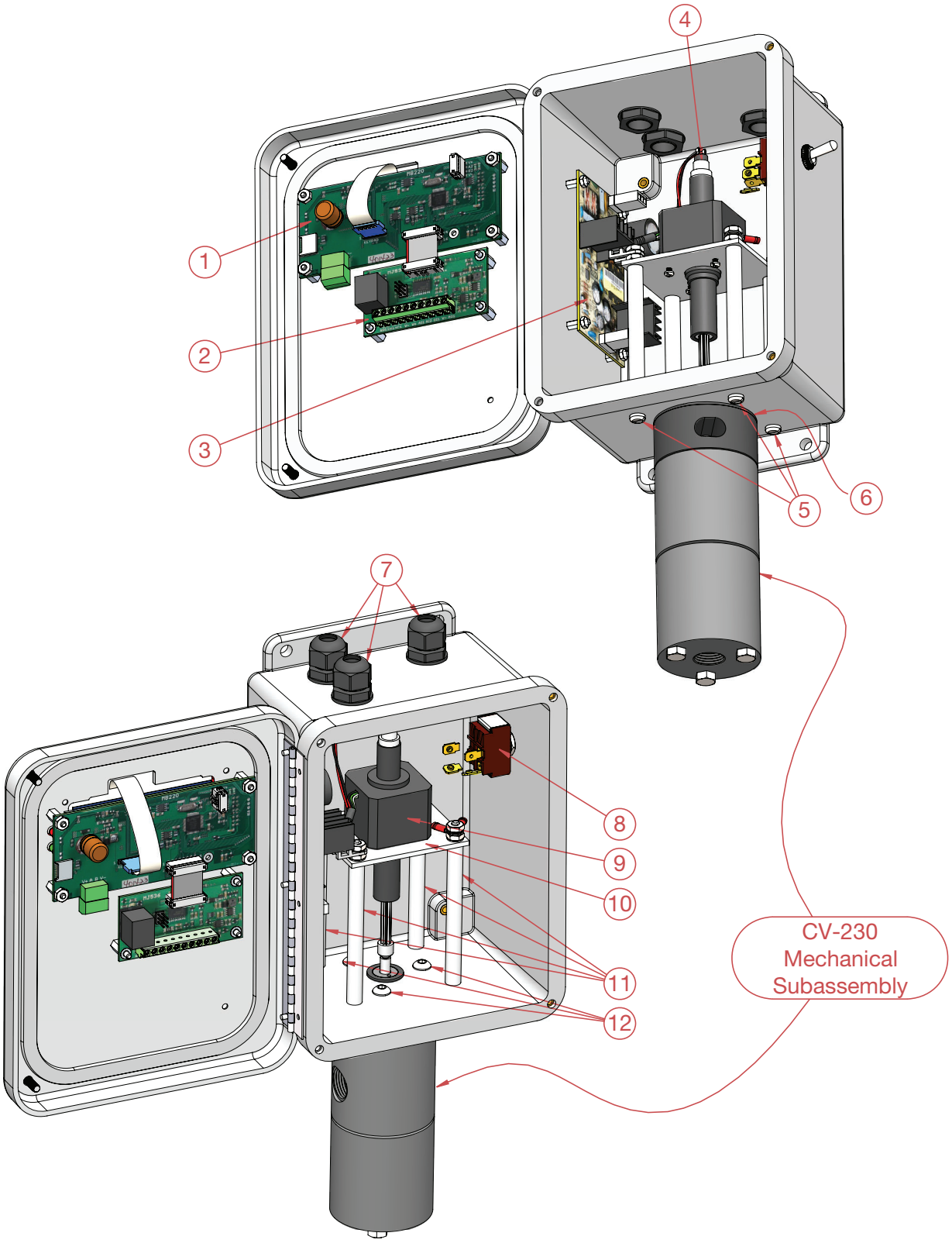


hydro INSTRUMENTS

CV-230 CONTROL VALVE
(MECHANICAL SUBASSEMBLY)

Date: 2022-12-09-v1
BILL OF MATERIALS
Dwg. No. CV-230, BOM

Item No.	Description	Quantity	Part No.
1	PM Seal Cap	1	OV2-33
2	PM Teflon Seal	2	OVS-108
3	PM O-Ring	2	OH-VIT-108
4	Upper Body	1	AVB-10-2
5	PM O-Ring	2	OH-VIT-124
6	Small Disc	1	AV-4
7	PM Stem Seal	1	OV-5
8	PM O-Ring	2	OH-VIT-116
9	Large Disc	1	AV-3
10A	Middle Body (250 PPD)	1	AV2-112-250
10B	Middle Body (500 PPD)	1	AV2-112-500
10C	Middle Body (2,000 PPD)	1	AV2-112-000
11	Valve Shaft	1	AV2-12
12A	Valve Stem (4 PPD)	1	AV2-72-004
12B	Valve Stem (10 PPD)	1	AV2-72-010
12C	Valve Stem (25 PPD)	1	AV2-72-025
12D	Valve Stem (50 PPD)	1	AV2-72-050
12E	Valve Stem (100 PPD)	1	AV2-72-100
12F	Valve Stem (250 PPD)	1	AV2-72-250
12G	Valve Stem (500 PPD)	1	AV2-72-500
13A	Valve Stem (1,000 PPD)	1	AV2-72-1000
13B	Valve Stem (2,000 PPD)	1	AV2-72-2000
13C	Valve Stem (8+)	1	AV2-72-000-8P
13D	Valve Stem (8++)	1	AV2-72-000-8PP
14	PM Valve Stem Seat (500 PPD)	1	AV2-62
15	PM Valve Stem Seat (2,000 PPD)	1	AV2-6-000
16A	Lower Body (250 PPD)	1	AV2-92-250
16B	Lower Body (500 PPD)	1	AV2-92-500
16C	Lower Body (2,000 PPD)	1	AV2-92-000
17	Bolts	3	¼"-20 x 5½"
18A	PM NPT Fitting (100 PPD) Not Shown	2	BKF-64
18B	PM NPT Fitting (250 PPD) Not Shown	2	BKF-84
18C	PM NPT Fitting (500 PPD) Not Shown	2	BKF-108
PM	Part & Maintenance Kit (100 PPD)		KT1-100-OV
PM	Part & Maintenance Kit (250 PPD)		KT1-250-OV
PM	Part & Maintenance Kit (500 PPD)		KT1-500-OV
PM	Part & Maintenance Kit (2,000 PPD)		KT1-040-OV



CV-230 CONTROL VALVE
(ELECTRICAL SUBASSEMBLY)

Date: 2019-02-06-v1
EXPLODED VIEW
Dwg. No. CV-230 ELE, EXP

Item No.	Description	Quantity	Part No.
1	CV-230 Display Board	1	Consult Factory
2	CV-230 Printed Circuit Board	1	Consult Factory
3	Power Supply Board 12VDC, 2.1 A	1	PSB-12VDV-OV
–	Mounting Screws for Power Supply Board	4	?
4	Home Switch Assembly with Threaded Adapter	1	OV-HOMESWITCH
5	10-24 x ⅝" Pan Head Machine Screw	4	BTH-STA-244
6	Upper Body Gasket	1	AV-GASKET
7	Liquid Tiight Fitting	3	BLT-199
–	Required O-Ring for Liquid Tight Fitting	3	OH-BUN-112
8	Toggle Switch	1	PTS-01
9	CV-230 Stepper Motor and Home Switch	1	CV-MOTOR
10	CV-230 Mounting Plate	1	MP-1
11	CV-230 Stand Off	4	AV-SO-2
12	Upper Body Bolt	3	BTH-STA-537