FAMILY OWNED

FLINT & WALLING

AMERICAN PROUD™

CMDR2/CMDR3 Variable Frequency Drive

Application Guide

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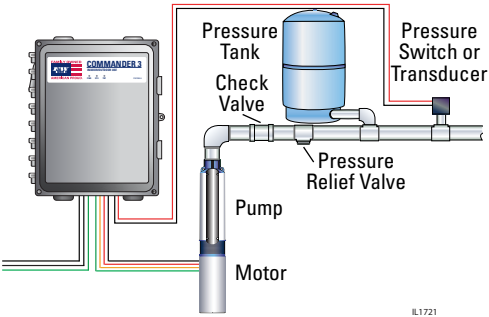
FW2314
0625 Supersedes 0325

Commander 2 – 1/2 thru 1-1/2 HP Single Phase

Commander 3 – 1/2 thru 2 HP Single/Three Phase

Controller Location Selection

- The NEMA 3R controller is intended for indoor and outdoor use and for operation in ambient temperatures up to 125° F (50° C).
- A tank tee is recommended for mounting the tank, pressure switch/transducer, pressure gauge, and pressure relief valve at one junction. If a tank tee is not used, the pressure switch/ transducer should be located within 6 ft. (1.8 meters) of the pressure tank to minimize pressure fluctuations. There should be no elbows between the tank and pressure switch/ transducer. There must be a check valve in-between the outlet of the pump and the pressure switch/transducer.
- The electronics inside the controller are air-cooled. As a result, there should be at least 6 inches of clearance on each side and below the unit to allow room for air flow.



Pressure Tank Sizing

Pump Flow Rating	Minimum Tank Size Up to 1 HP	Minimum Tank Size Above 1 HP
Less than 12 gpm (45.4 lpm)	2 Gal (7.6 liters)	4 Gal (15.2 liters)
12 gpm or higher (45.4 lpm)	4 Gal (15.2 liters)	8 Gal (30.3 liters)

Max. Pump Flow	Pump Flow Rating
12 gpm (45.4 lpm)	2 Gal (7.6 liters)
20 gpm (75.7 lpm)	4 Gal (15.2 liters)
30 gpm (113.6 lpm)	6 Gal (22.7 liters)
40 gpm (151.4 lpm)	4 Gal (30.3 liters)

Note: A minimum tank size of 20 gallons is recommended when using a F&W 2-Wire motor. This is to ensure water is available during the minimum off time of the motor. If a smaller tank is used, the tank may empty if a large water demand directly follows the motor turning off.

Motor Wire Sizing

Motor	Phase	Motor HP	Motor Voltage	AWG 600V Copper Wire Sizes, 75° C Insulation Motor Cable Lengths (in feet)[1]					
				14	12	10	8	6	4
137428	1	1/2	230	400	620	1000	-	-	-
137430	1	3/4	230	300	465	765	1000	-	-
137432	1	1.0	230	230	355	590	890	1000	-
137434	1	1.5	230	185	280	465	705	1000	-
137435	1	2.0	230	155	240	395	605	955	1000
137585	3	1/2	230	930	1000	-	-	-	-
137586	3	3/4	230	670	1000	-	-	-	-
137587	3	1.0	230	560	910	1000	-	-	-
137588	3	1.5	230	420	670	1000	-	-	-
137589	3	2.0	230	320	510	810	1000	-	-

Input Voltage	Motor HP	Fuse/Breaker Amps	AWG Copper Wire Sizes, 75° C Insulation Panel to Controller Cable Lengths (in feet)[1]								
			14	12	10	8	6	4	3	2	1
230	1/2	15	130	205	340	520	830	1310	1630	2145	2715
230	3/4	15	125	150	250	385	615	970	1200	1590	2010
230	1.0	20	70*	110*	180	280	445	710	880	1160	1470
230	1.5	25	–	–	140	210	340	540	665	875	1110
230	2.0	25	–	–	105	165	260	530	665	840	1060

[1] Based on a 3% voltage drop. * 90 °C Insulation only.

Drive Interface Lights

1. Power Light: A solid green light indicates that the controller is powered up.
2. Status Light: A solid or blinking green light indicates the controller state.
3. Trip Light: A solid or blinking light indicates a problem with the system.

Light	Running	Idle	Off	Trip
PWR	●	●	○	●
STS	●	○	○	○
TRP	○	○	○	✸

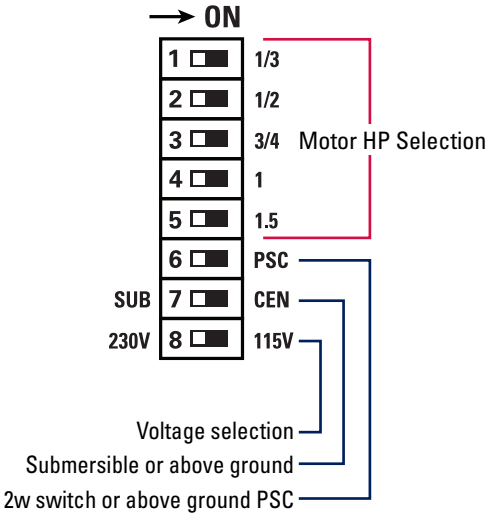
ON: ● OFF: ○ BLINKING: ✸

	Commander 2	Commander 3
- MODEL #	**CMDR2-T CMDR2-S**	**CMDR3-T CMDR3-S**
	Models ending with a "T" include a Transducer. Models ending with a "S" include a Switch.	
- HP	**1/2 to 1-1/2 HP**	**1/2 to 2 HP**
- MOTOR TYPE	2-wire 4" Submersible motors PSC Above ground motors*	3-wire Single or Three phase 4" sub. motors 3 Phase above ground motors
- OUTPUT PHASE	Single phase	Single / Three phase
- MAX OUTPUT CURRENT	13.1 / 7.0 CSIR**	13.2 Single phase 8.1 Three phase
- INPUT VOLTAGE	230 +/- 10% VAC	
- PRESSURE SETTING	25-80 PSI using pressure sensor 10-90% of range using 0-100 PSI transducer	
- Ambient Temperature	0° C (32° F) to 50° C (125° F)	

* PSC: Permanent Split Capacitor ** CSIR: Capacitor Start Induction Run

Motor Type Selection

Switch Bank 1 — CMDR2



Motor Type Selection

Switch Bank 1 — CMDR2

Submersible PSC Pumps (DIP SW1 – Pos. 6)
When using a submersible PSC style motor, SW1 – Pos 6 (PSC) must be in the LEFT position. Operate as a standard submersible motor.

Maximum Amps (DIP SW1 – Positions 1–5)
If either SW1 – Position 6 or 7 is in the RIGHT position, switches 1–5 are re-purposed to configure maximum amp settings for above ground PSC motors.

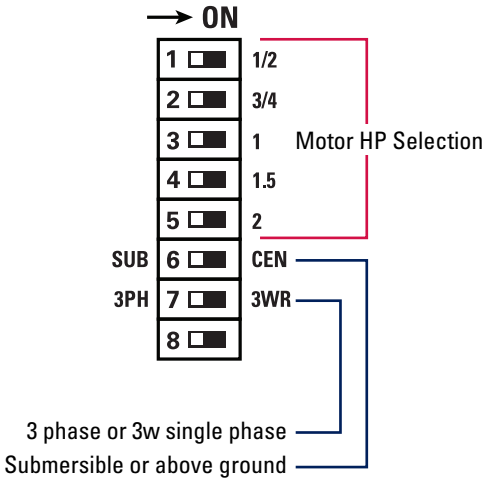
NOTE: Due to the the inrush current characteristics of above ground PSC motors the drive is limited to motors rated equal to or less than 8.1 MAX AMPS

Use the following table to select the combination of DIP switches that corresponds to an overload current value equal to or less than the motor nameplate current rating.

Max Amps	SW1				
	1	2	3	4	5
4.6	←	←	←	←	←
4.7	→	←	←	←	←
5.0	←	→	←	←	←
6.0	→	→	←	←	←
6.2	←	←	→	←	←
6.4	→	←	→	←	←
8.1	←	→	→	←	←
8.4	→	→	→	←	←
9.1	←	←	←	→	←
9.5	→	←	←	→	←
9.8	←	→	←	→	←
10.0	→	→	←	→	←
10.4	←	←	→	→	←
11.0	→	←	→	→	←
12.0	←	→	→	→	←
13.1	→	→	→	→	←
LEGEND:	OFF ←	ON →			

Motor Type Selection

Switch Bank 1 — CMDR3



Motor Type Selection

Switch Bank 1 — CMDR3

Select Motor Type (DIP SW1 – Pos. 6)
When using a submersible style motor, SW1 – Pos 6 (SUB) must be in the LEFT position.
When using an above ground pump, SW1 – Pos 6 (CEN) must be in the RIGHT position.

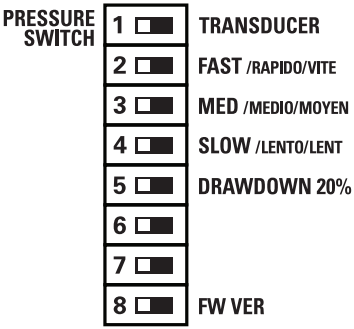
Above Ground Pumps Maximum Amps (DIP SW1 – Pos. 1-5)
When the drive is configured to operate an above ground 3-phase style pump. SW1 – Positions 1-5 must be used to set the correct MAX AMPS motor overload current to properly protect the motor.

Use the following table to select the combination of DIP switches that corresponds to an overload current value equal to or less than the motor nameplate current rating.

Max Amps	SW1				
	1	2	3	4	5
2.6	←	←	←	←	←
3.0	→	←	←	←	←
3.6	←	→	←	←	←
3.8	→	→	←	←	←
4.0	←	←	→	←	←
4.1	→	←	→	←	←
4.6	←	→	→	←	←
4.7	→	→	→	←	←
5.3	←	←	←	→	←
5.9	→	←	←	→	←
6.2	←	→	←	→	←
6.6	→	→	←	→	←
6.8	←	←	→	→	←
8.1	→	←	→	→	←
8.5	←	→	→	→	←
8.6	→	→	→	→	←
LEGEND:	OFF ←	ON →			

Motor Control Selection

Switch Bank 2



System Response (transducer only)
In some systems, a faster response times can improve pressure stability. However, if the response is too fast, the system pressure could overshoot, leading to overpressure, rapid cycling, or hydraulic noise. Select one DIP switch for preset FAST, MED, or SLOW system response parameters. Selecting more than one switch will result in an Invalid Configuration fault. If no selection is made, the system will default to SLOW (no fault occurs).

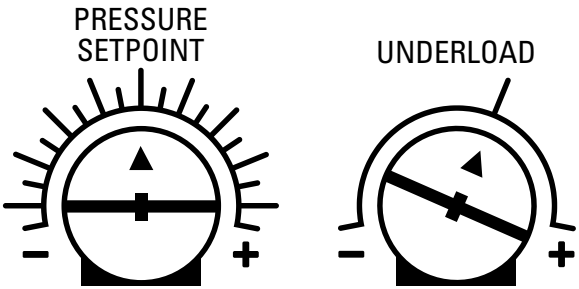
Drawdown (transducer only)
When using a pressure transducer, the default cut-in pressure is 5% of transducer range below the system pressure setpoint. Setting DIP SW2 Position 5 in the DD (RIGHT) position will change the cut-in pressure to 20% below the system pressure setpoint.

Pressure Setpoint

When using a 4-20 mA pressure transducer, the desired system pressure is set by using the pressure setpoint adjustment knob. The knob is factory set to 50% of the transducer range and is adjustable from 10% to 90% in 5% increments. This allows any range of pressure transducer to be used. Refer to the indicator lines surrounding the knob and the corresponding legend printed on the divider when setting the desired pressure setpoint.

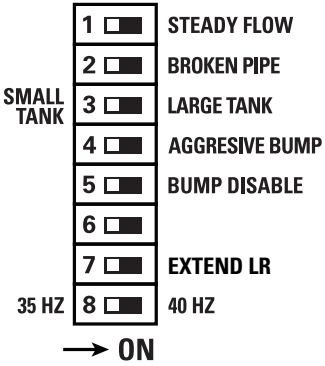
The pressure setpoint must be adjusted with the drive powered OFF. The new setting will not take effect until the drive power is cycled.

NOTE: This knob is only compatible with a 4-20 mA pressure transducer. A pressure transducer must be installed in the system, and DIP SW2 Position 1 must be in the XDCR (RIGHT) position.



Motor Settings Selection

Switch Bank 3 — CMDR2



Steady Flow Operation (switch only)
The Commander 2 is set at the factory to ensure quick response to maintain constant pressure. In some applications, the drive may offer better control through a slower response time. Adjusting the pressure control response time by enabling the Steady Flow operation may be helpful (a water line tapped before the pressure tank, or close to the well head, or where noticeable speed variations of the pump can be heard through the pipes).

Motor Settings Selection
Switch Bank 3 — CMDR2

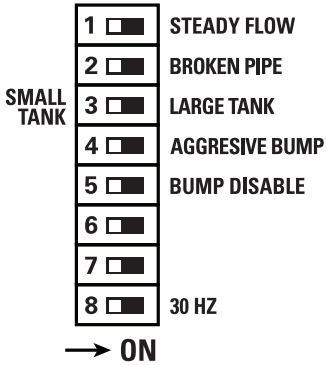
Tank Size
If the system is having difficulty shutting off & going into standby in transducer mode, SW3-Pos. 3 should be moved to the large tank (RIGHT) position.

Aggressive Bump Adjustment (switch only)
The bump mode feature periodically increases the speed of the pump, increasing pressure several PSI above the set point allowing the controller to shut off the pump and go into standby. In installations where the default bump setting is not enough for the drive to go into standby as expected, the aggressive bump mode can be activated.

Minimum Output Frequency Adjustment
For submersible pumps, the default minimum frequency is 35 Hz. In some installations to avoid resonance vibration noise, the minimum frequency can be increased to 40 Hz. Moving SW3- Pos. 8 to the Hz (RIGHT) position will increase the minimum running frequency to 40 Hz. Note: For above ground applications, the minimum frequency is 40 Hz, so this switch does not have any effect.

Motor Settings Selection

Switch Bank 3 — CMDR3



Steady Flow Operation (switch only)
The Commander 2 is set at the factory to ensure quick response to maintain constant pressure. In some applications, the drive may offer better control through a slower response time. Adjusting the pressure control response time by enabling the Steady Flow operation may be helpful (a water line tapped before the pressure tank, or close to the well head, or where noticeable speed variations of the pump can be heard through the pipes).

Motor Settings Selection

Switch Bank 3 — CMDR3

Tank Size
If the system is having difficulty shutting off & going into standby in transducer mode, SW3-Pos. 3 should be moved to the large tank (RIGHT) position.

Aggressive Bump Adjustment (switch only)
The bump mode feature periodically increases the speed of the pump, increasing pressure several PSI above the set point allowing the controller to shut off the pump and go into standby. In installations where the default bump setting is not enough for the drive to go into standby as expected, the aggressive bump mode can be activated.

Minimum Output Frequency Adjustment
For 3-Phase and 3-wire Submersible, the minimum frequency is always 30 Hz. The minimum frequency is adjustable. for surface motors. Set SW3 position 8 to the left position, for 15 Hz minimum frequency. Set SW3 position 8 to the right position, for 15 Hz minimum frequency.

Underload Sensitivity

The Commander Drives are configured at the factory to ensure detection of Underload faults in a wide variety of applications. At times, this trip level may result in unnecessary faults and require small adjustments.

NOTE: When set for use with an above ground pump, the drive includes a set delay to allow the pump to fully prime. Each time the pump is started, any underload condition will be ignored for a period of two minutes to allow the pump to prime. If it becomes necessary to adjust the Underload trip level, power down and wait ten minutes for the controller to discharge the stored energy.

Shallow Set: If the pump is installed in an extremely shallow or artesian well and the controller trips on an underload fault, the Underload Potentiometer will need to be turned counterclockwise to a drop the sensitivity setting. Check operation of the system and repeat as necessary.

Deep Set: In cases where the pump is set very deep, run the system at open discharge to pump the well down and observe to make sure that an underload is detected properly. If the system does not trip as it should, the Underload potentiometer will need to be adjusted clockwise to increase the sensitivity setting. Check operation of the system and repeat as necessary.

The Underload Sensitivity must be adjusted only when the drive is Powered Down. The new setting will not take effect until the drive is powered up.

Inside the Commander VFD

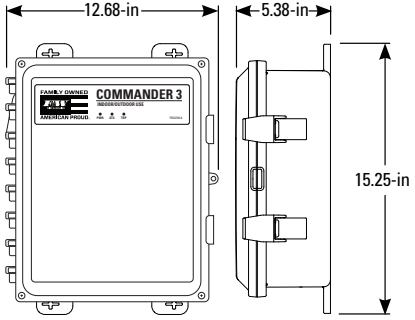
Premium Enclosure

- Composite enclosure for quiet operation
- Hinged cover for easy access
- Side mounted ventilation
- Full size cooling fan for maximum air flow and temperature control
- NEMA 3R enclosure with premium heatsink
- USB compatible updates

Easy to use components

- Drive status indicator lights
- Settings adjustment DIP switches with large easy to read diagram
- Convenient dial for precise underload sensitivity and pressure adjustment
- Compatible with both pressure transducer and switch
- Quality terminal blocks with spacious wiring area
- Models ending in “T” include a 0-100 PSI transducer with a 16.4ft cable

Mounting bracket pattern: Width 7.63-in Height 14.03-in



Problem Diagnosis Chart

The following trip codes are represented by the Power light: On, Status light: Off, and the Trip light: blinking at the noted rate.

No. of Blinks: 1 — Trip: Underload

Possible Cause

1. Over-pumped/dry well
2. Broken pump shaft
3. Blocked pump screen
4. Worn pump
5. Air/gas locked pump
6. Underload sensitivity incorrect
7. Incorrect current/HP setting

No. of Blinks: 2 — Trip: Undervoltage

Possible Cause

1. Low Line Voltage
2. Loose connection at breaker
3. Tripped breaker/Fuse

No. of Blinks: 3 — Trip: Locked Rotor

Possible Cause

1. Motor & pump misaligned
2. Bound Pump
3. Motor bearing failure
4. Incorrect current/HP setting
5. Locked rotor measurement parameters
   SW03-Pos.7 to ON to extend. (internal to drive)

No. of Blinks: 4 — Trip: Incorrectly Wired
Possible Cause
1. Wrong DIP switch setting for motor type
2. Motor lead connection incorrect

No. of Blinks: 5 — Trip: Open Circuit
Possible Cause
1. Loose connection
2. Defective splice
3. Defective cable
4. Open motor winding

No. of Blinks: 6 — Trip: Short Circuit
Possible Cause
1. Shorted motor cables
2. Shorted motor
3. Damaged wire insulation
4. Internal hardware short

No. of Blinks: 7 — Trip: Overheated Controller
Possible Cause
1. Direct sunlight
2. Obstruction of airflow
3. Fan failure

Rapid Blink — Trip: Internal Fault
Possible Cause
1. Internal drive fault detected

Additional Fault Codes

Lights	Trip	Possible Causes	Corrective Actions
PWR ●	Invalid Configuration	DIP switches are set incorrectly.	Verify DIP switch setting per instructions.
STS ●			
TRP ●			
PWR ●	Broken Pipe	Drive has run at full power for 10 minutes without reaching setpoint.	Check system for a broken pipe of large leak.
STS ✸			If the application contains a sprinkler or is being used to fill a pond or pool, disable the Broken Pipe detection.
TRP ○			
PWR ●	Transducer Fault	DIP SW2-Pos 1 incorrectly set.	Verify DIP switch SW2-Pos 1 is set to RIGHT for transducer of LEFT for switch operation.
STS ✸		Transducer is incorrectly wired.	Verify transducer wiring connections.
TRP ✸		Transducer is damaged or failed.	Replace Transducer.

ON: ● OFF: ○ BLINKING: ✸

Notes

Groundwater Support Team
1-800-828-2313 • 1-280-599-8345 • GWTech@FlintandWalling

Flint & Walling, Inc. • 800-345-9422 • ***www.FlintandWalling.com***