EN

SubDrive1100/1500/2200 Connect IP 23

Owner's Manual

Before Getting Started

⚠ WARNING

Serious or fatal electrical shock may result from failure to connect the ground terminal to the motor, SubDrive controller, metal plumbing, or other metal near the motor or cable, using wire no smaller than motor cable wires. To minimize risk of electrical shock, disconnect power before working on or around the SubDrive system. CAPACITORS INSIDE THE SUBDRIVE CONTROLLER CAN STILL HOLD LETHAL VOLTAGE EVEN AFTER POWER HAS BEEN DISCONNECTED.

ALLOW 5 MINUTES FOR DANGEROUS INTERNAL VOLTAGE TO DISCHARGE BEFORE REMOVING SUBDRIVE COVER.

Do not use motor in swimming areas.

⚠ ATTENTION

This equipment should be installed by technically qualified personnel. Failure to install it in compliance with national and local electrical codes and within Franklin Electric recommendations may result in electrical shock or fire hazard, unsatisfactory performance, or equipment failure. Installation information is available through pump manufacturers and distributors, or directly from Franklin Electric at our toll-free number 1-800-348-2420.

⚠ CAUTION

Use SubDrive only with Franklin Electric 4-inch submersible motors as specified in this manual (see pg. 41-44). Use of this unit with any other Franklin Electric motor or with motors from other manufacturers may result in damage to both motor and electronics. In applications where water delivery is critical, a replacement pressure sensor and/or back-up system should be readily available if the drive fails to operate as intended.

FE Connect

FE CONNECT MOBILE APP

Wi-Fi connectivity is a feature of the drive that enables a connection to be made with a single Wi-Fi device (smartphone or tablet). The connection can be used to monitor drive characteristics, adjust advanced settings, and view or email fault history and configuration changes. The mobile app can be downloaded from the Apple App Store or Google Play ™.

GET THE FE CONNECT APP TODAY!

Download on the App Store

GET IT ON Google play

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*Google Play™ is a trademark of Google Inc.

EN

Table of Contents

Declaration of Conformity

Model No.	Model Description
5870205153C	SubDrive 1100 Connect IP23
5870205353C	SubDrive 1500 Connect IP23
5870205453C	SubDrive 2200 Connect IP23

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E184902

MOTOR OVERLOAD PROTECTION NOTE:

The drive electronics provide motor overload protection by preventing motor current from exceeding the maximum Service Factor Amps (SFA). Motor overtemperature sensing is not provided by the drive.

BRANCH CIRCUIT PROTECTION

Integral solid state short circuit protection does not provide branch circuit protection. Branch circuit protection must be provided in accordance with the National Electrical Code and any additional local codes, or the equivalent. Drive shall be protected by inverse-time fuse or Circuit breaker only, rated 300 V, maximum and per the full-load motor output current rating as noted in the Fuse/Circuit Breaker and Wire Sizing section on pg. 20.

INTERNAL LITHIUM BATTERY

CAUTION: Never place lithium batteries in mouth. If swallowed, contact your physician or local poison control center. If battery is damaged, do not use. Battery shall be serviced or replaced by a qualified serviceman.

Store new batteries only in the manufacturer's containers. Dispose/recycle used and damaged batteries per local, regional, and national laws and regulations.

MAINTENANCE

Unless needed by accessory kit or noted within this manual, no additional SubDrive maintenance is required.

Wi-Fi MODULE

The Wi-Fi module has been tested and found to comply with part 15 of FCC Rules. These limits are designed to provide reasonable protection against harmful interference. This equipment generates, uses, and can radiate radio frequency energy for limited periods (approx. 15 min.) and, if the drive is not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Declaration of Conformity

Franklin Electric Corp.
9255 Coverdale Rd.
Fort Wayne, IN 46809 USA

EU Authorized Representative:
Franklin Electric Europa GmbH
Rudolf-Diesel-Staße 20
D-54516 Wittlich
E-mail: info@franklin-electric.de
www.franklinwater.eu

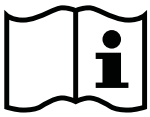
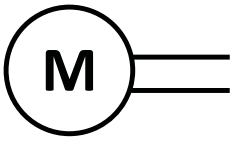
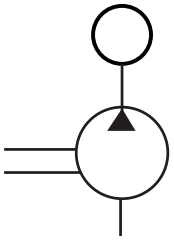
Herewith, we declare under our sole responsibility that Variable Frequency Drives marked with the following numbers SubDrive 1100, 1500, 2200 conform with the provisions of the Low Voltage Directive (LVD) 2014/35/EU, and the Electromagnetic and Compatibility Directive (EMC) 2014/30/EU. These drives are intended for use with Franklin Electric submersible motors within the nameplate ratings.

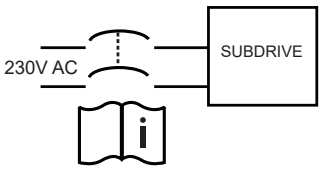
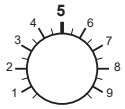
The following harmonized standards and technical specifications have been applied:

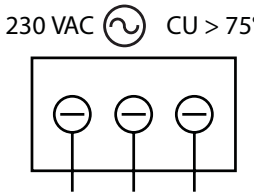
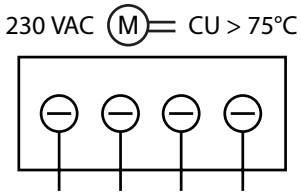
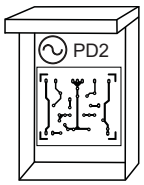
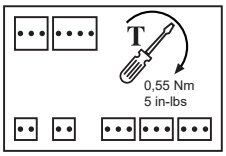
EN 61800-5-1: 2007, A1: 2013	ADJUSTABLE SPEED ELCTRICAL POWER DRIVE SYSTEMS - Part 5-1: Safety requirements Electrical, thermal and energy.
EN 61800-3: 2004 A1: 2012	Adjustable speed electrical power drives systems. EMC requirements and specific
EN 60529: 1989/A2: 2013	Degrees of protection provided by enclosures (IP code).

CE

Authorized Signature: Robert P. Agnew
Date: 3 August 2016
Title: Electronic Certifications Engineer

	Refer to this Manufacturer's manual for details
	Tighten Terminals to 1.7 Nm (15 in-lbs)
	Motor
	Pump
	On
	Off

	Suitable For Use on Circuit Delivering Not More Than 5000 RMS Symmetrical Amperes, 250 V Maximum.
	Caution - Dangerous Voltage - Risk of Electrical Shock.
DEFAULT  **UNDERLOAD**	Underload Adjustment
bar **5**  **PRESSURE TRANSDUCER**	Pressure Set Point Adjustment
	Protective Earth Conductor
	Caution
NC NO COM	Normally Close Contact Normally Open Contact Common Contact

	Mains Connections: Use Copper Wire 75 °C, 300 VAC Minimum.
	Mains Connections: Use Copper Wire 75 °C, 600 VAC Minimum.
SF 1~ 3~ BRN GRY BLK	Steady Flow Single-Phase Output Setting Three-Phase Output Setting Brown Motor Wire Gray Motor Wire Black Motor Wire
	Pollution Degree 2
	Tighten Terminals to 0.55 Nm (5 in-lbs)
PS XDCR L N	Pressure Sensor/Switch Pressure Transducer 230VAC Mains Line 230VAC Mains Neutral

Description and Features

Description

The Franklin Electric SubDrive is a variable frequency controller that uses advanced electronics to protect the motor and enhance the performance of standard pumps used in residential and light commercial water system applications. When used with Franklin Electric motors (see Table 2 on Page 21), the SubDrive provides constant “city-like” water pressure by eliminating the effects of pressure cycling associated with conventional water well systems.

Features and Benefits

Constant Water Pressure

The Franklin Electric SubDrive provides consistent pressure regulation using advanced electronics to drive a standard motor and pump according to the pressure demands indicated by a highly accurate, heavy-duty, long-life pressure sensor or analog pressure transducer. By adjusting the motor/pump speed, the SubDrive can deliver constant pressure dependably, even as water demand changes. For example, a small demand on the system, such as a bathroom faucet, results in the motor/pump running at a relatively low speed. As greater demands are placed on the system, such as opening additional faucets or using appliances, the speed increases accordingly to maintain the desired system pressure. Using the provided analog pressure transducer, system pressure can be set in the range of 0.5 to 9.5 bar (7.3 – 137.8 psi).

Reduced Tank Size

Conventional systems use larger tanks in order to store water, whereas SubDrive systems utilize a smaller tank in order to maintain constant pressure. See Table 3 on page 22 for pressure tank size requirements.

Reduced Pump Size

SubDrive controllers fit the pump to the application by adjusting the speed of the pump and motor. In SubDrive applications a pump with a power rating of half the motor power rating can be used when properly sized. See pump sizing information on pg. 23-25.

Over Temperature Foldback

SubDrive controllers are designed for full power operation in ambient temperatures up to 50 °C (122 °F) at nominal input voltage. In extreme thermal conditions, the controller will reduce output power in an attempt to avoid shutdown and potential damage while still trying to provide water. Full output power is restored when the internal controller temperature cools to a safe level.

Motor Soft Start

Normally, when there is a demand for water, the SubDrive will be operating to accurately maintain system pressure. Whenever the SubDrive detects that water is being used, the controller always “ramps up” the motor speed while gradually increasing voltage, resulting in a cooler motor and lower start-up current compared to conventional water systems. In those cases where the demand for water is small, the system may cycle on and off at low speed. Due to the controller’s soft-start feature and the sensor’s robust design, this will not harm the motor or the pressure sensor.

Power Factor Correction

Active Power Factor Correction (PFC) minimizes input RMS current by allowing the drive to draw a cleaner, sinusoidal input current waveform. This allows for a reduction in input power cable size when compared to similar applications without power factor correction, because less average current is used by the drive for a given load when compared to non-PFC devices.

Ground Fault Detection

The drive is equipped with Ground Fault Protection for the motor output. In the event that a current leak to ground is detected on the motor output, the drive will indicate a Ground Fault (Fault Code F16). See the Diagnostic Fault Codes table at the end of the instruction manual for more information.

Adjustable Underload Sensitivity

The SubDrive controller is configured at the factory to ensure detection of Underload faults in a wide variety of pumping applications. In rare cases (as with certain pumps in shallow wells) this trip level may result in nuisance faults. If the pump is installed in a shallow well, activate the controller and observe system behavior. Once the controller begins to regulate pressure, check operation at several flow rates to make sure the default sensitivity does not induce nuisance Underload trips. See Basic Set-up section on page 34 for details regarding the Underload Potentiometer.

System Run Relay

The SubDrive is fitted with a relay output that activates (normally-open contact will close) whenever the system is actively pumping. Both normally-open (NO) and normally-closed (NC) contacts are provided. The contacts are rated 5 A at 250 VAC/30 VDC for general purpose loads, or 2A at 250 VAC/30 VDC for inductive loads (i.e. relay).
It is not recommended to use this function relay to control critical systems (chemical dosing, etc.)

System Fault Relay

The SubDrive is fitted with a relay output that activates (normally-open contact will close) whenever the system is faulted. Both normally-open (NO) and normally-closed (NC) contacts are provided. The contacts are rated 5 A at 250 VAC/30 VDC for general purpose loads, or 2A at 250 VAC/30 VDC for inductive loads (i.e. relay). It is not recommended to use this function relay to control critical systems (chemical dosing, etc.).

Analog Pressure Transducer

The SubDrive Connect IP 23 family of controllers support a 4-20mA analog pressure transducer input (10 bar analog transducer is included with the controller). The default pressure range is 0.5 - 9.5 bar with an adjustment knob provided to set the desired system pressure. The drive will display the system pressure (ex. “5.5 b” for 5.5 bar) when using an analog pressure transducer rather than motor speed when using the traditional SubDrive pressure sensor. Additional pressure transducer ranges are supported by using the FE Connect mobile app.

Moisture / Wet Floor Sensor

An additional input to support an optional Franklin Electric Moisture Sensor (often referred to as a “Wet Floor Sensor”) has been added to the SubDrive Connect IP 23 drive family. When the system is equipped with a moisture sensor, the drive will stop pumping and indicate a specific fault code when the sensor detects the presence of water. This does not replace the need for a pressure relief valve in the system. Refer to the Accessories page for ordering information.

Wi-Fi and FE Connect Mobile App

Wi-Fi connectivity is included in the drive to enable a connection to be made between the drive and a single Wi-Fi capable device (smartphone, tablet, etc.). This connection can be used in order to adjust advanced settings, monitor drive characteristics, and view fault history when using the FE Connect mobile app. See the Advanced Set-up section on page 35 of this manual for more details regarding the capabilities of the Wi-Fi connection.

Auxiliary Control Input (App Only)

A 24 VDC dry-contact, digital control input labeled “Aux In” is provided to allow for additional external control of the SubDrive controller. This input can be set using the FE Connect mobile app to control the drive in the following ways: fault when high, fault when low.

Drawdown (App Only)

When using an analog pressure transducer in the system, an optional “cut-in” pressure can be set to allow for pressure drawdown in the system. For example, a system set point pressure of 5 bar and a cut-in pressure of 2 bar would allow the drive to regulate system pressure at 5 bar when running, but will not turn the drive on until the system pressure drops below 2 bar. The FE Connect mobile app is required to activate and set the cut-in pressure.

Duplex Alternator Built-In (App Only)

The capability of the SubDrive Connect Duplex Alternator product has now been built into the SubDrive IP 23 product family. A communication cable connected between two (2) drives and the FE Connect mobile app are required to activate this feature.

Adjustable Underload Off Time (App Only)

The Underload Off Time determines how long the drive will wait before attempting to run following an Underload event. The default time is 5 minutes, but is user-adjustable through the Wi-Fi interface from 1 minute to 48 hours.

System Diagnostics Fault History (App Only)

In addition to regulating pump pressure and accurately controlling motor operation, the SubDrive continuously monitors system performance and can detect a variety of abnormal conditions. In many cases, the controller will compensate as needed to maintain continuous system operation; however, if there is a high risk of equipment damage, the controller will protect the system and display the fault condition. If possible, the controller will try to restart itself when the fault condition subsides. Each time a fault is detected in the system, the drive records the fault and the the actual date and time when the fault was detected. A maximum of 500 events are recorded and can be viewed and emailed using the FE Connect mobile app.

Adjustable Bump Modes (App Only)

Using the Advanced Setup (Wi-Fi and FE Connect App), the bump mode and tank size settings of the drive can be changed. Bump mode controls how hard the drive will pump for the very short time period just before attempting to shut down. The drive ships with default settings that are compatible with the majority of SubDrive applications. For applications with large pressure tanks or trouble shutting down, the bump mode can be modified to be more aggressive. The system behavior should be monitored when adjusting these settings to ensure proper operation.

Replaceable Parts

Cooling Fan

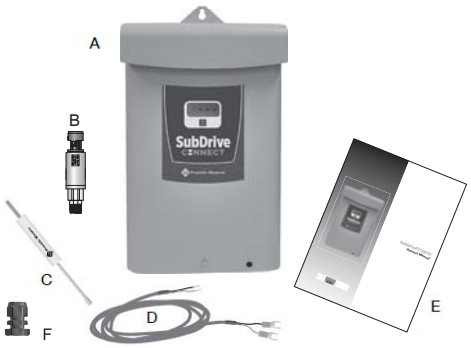
In the event that the cooling fan fails and results in an occurrence of frequent Overheated Drive faults (Fault Code F7), the fan is able to be replaced. See Accessories section for information regarding IP 23 Fan Replacement kits.

Enhanced Pressure Input Board

In the event that a lightning strike creates a surge on the various I/O terminals of the drive, the Enhanced Pressure Input Board (EPIB) can become damaged causing the drive to not operate. Rather than replacing the entire drive, the EPIB can be replaced in an attempt to repair the drive. See the Accessories section for information regarding the Enhanced Pressure Sensor Input Board Replacement kit.

In the Box

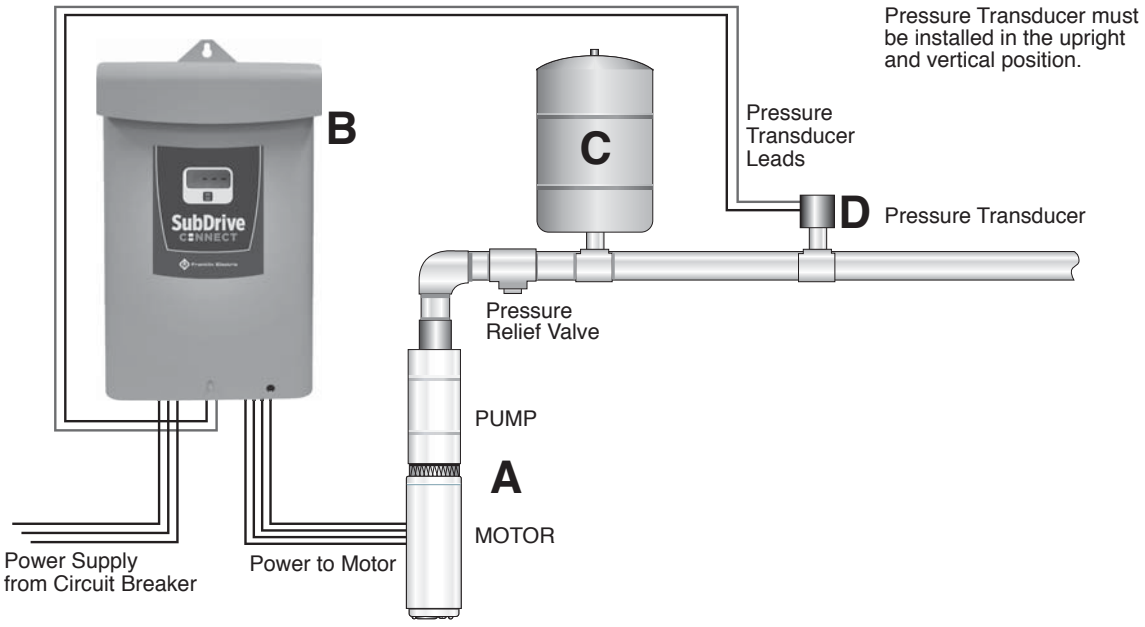
A. Controller Unit
B. Analog Pressure Transducer
C. Screwdriver/Adjustment Tool
D. Transducer Cable
E. Installation Guide
F. Strain Relief Fitting



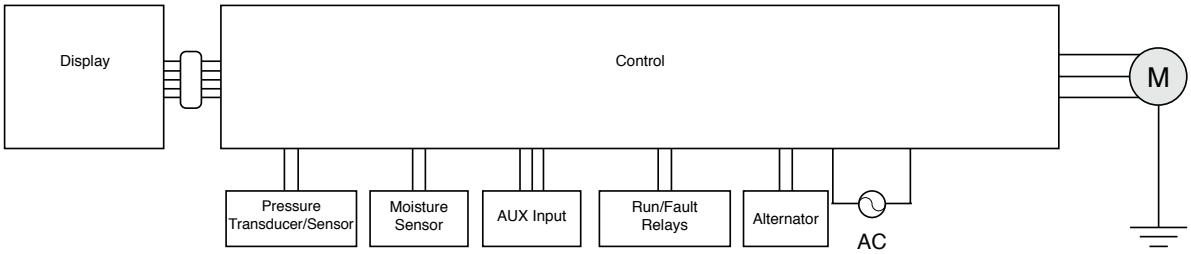
How it Works

The Franklin Electric SubDrive is designed to be part of a system that consists of only four (4) components:

A. Standard Pump and Franklin Electric Motor
B. SubDrive Controller
C. Small Pressure Tank (see Table 3, page 22)
D. Analog pressure transducer

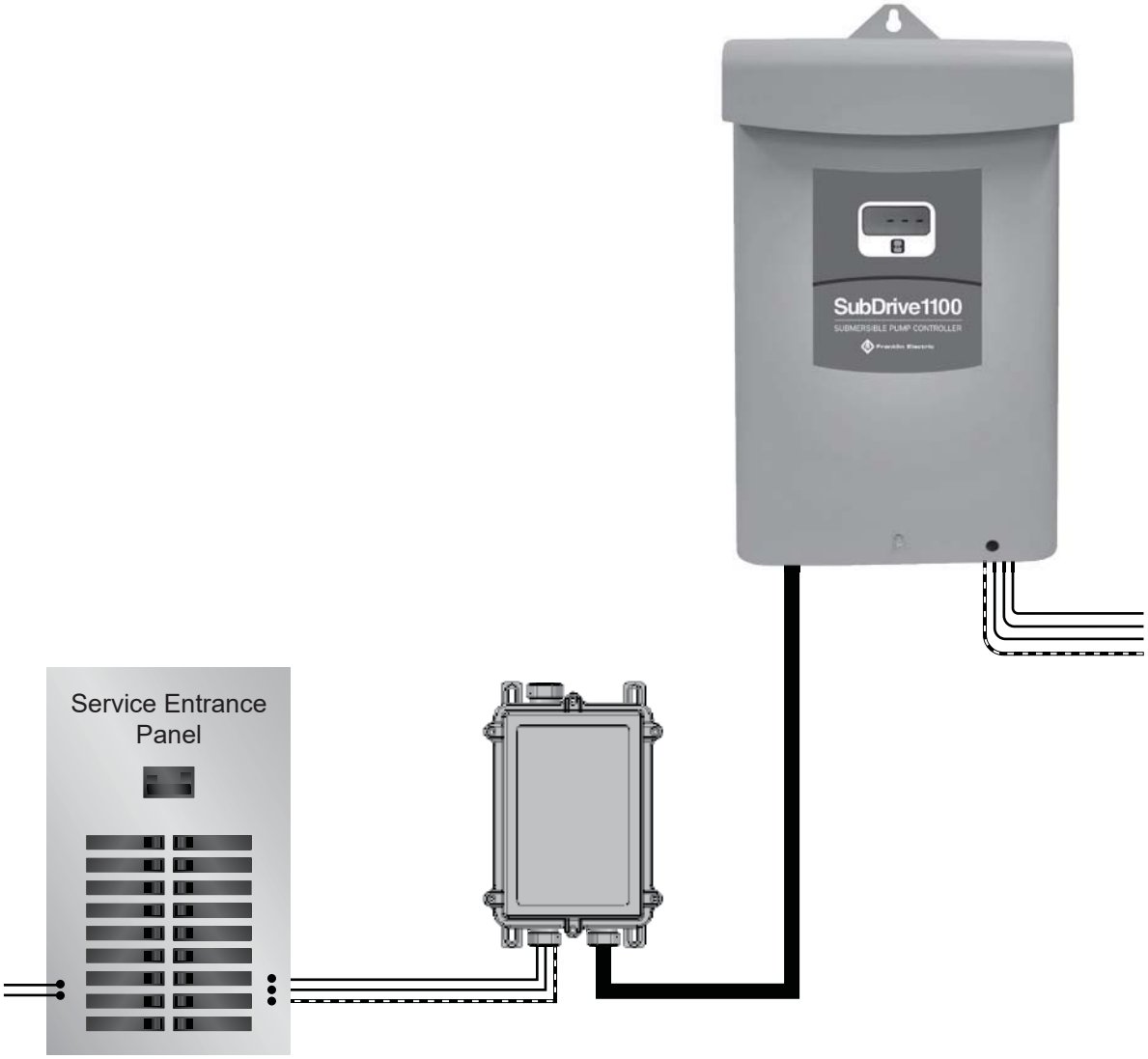


Electrical Diagram



Special Considerations EMC

EMC conformance to EN61800-3 was attained using Franklin Electric Line Filter Part No. 226205901 and shielded motor cable (30m / 100ft). Additional EMC mitigation for other installations may be necessary.



Drive Display

Drive Running

When the SubDrive unit is controlling the motor and pump, the display will be illuminated and the following information will be shown on the display:

- System pressure (in bar) when using an analog pressure transducer. When displaying system pressure, the display will include a “b” suffix to the numerical pressure reading to distinguish it from motor speed. The "b" will steadily flash on and off when the drive is running.

- Motor/pump speed (in Hz) when using the standard pressure sensor.

System Idle

When the SubDrive unit is powered on and idle (not pumping water), the display will be illuminated and the following will be shown on the display:

- System pressure (in bar) with the "b" on steady (not flashing) when using an analog pressure transducer - "- - -" when using the standard pressure sensor.

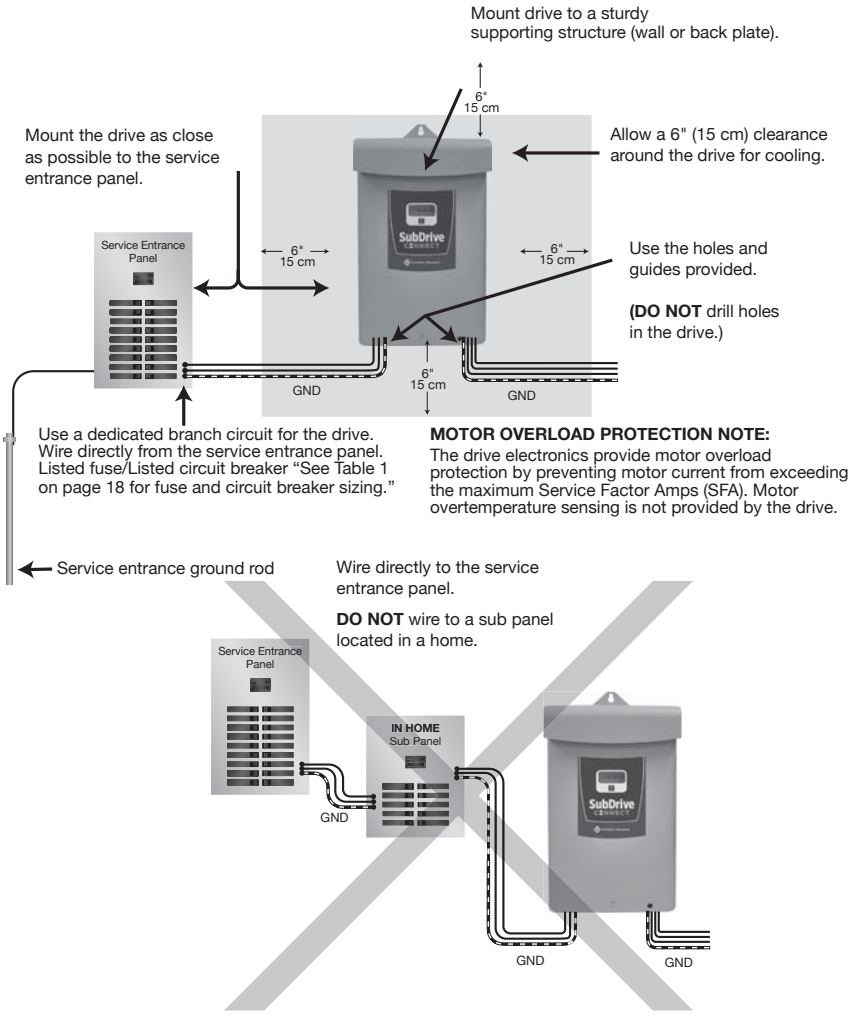
Fault Detected

When a fault condition is detected in the system, the drive display will illuminate red and the fault code will be displayed. All fault codes begin with “F” and followed by a one- or two-digit number. Consult the Diagnostic Fault Codes table in the back of this manual for more information.

Location of Drive

The SubDrive controller is intended for operation in ambient temperatures from -25 °C to 50 °C (-13 °F to 122 °F) at 208/230 VAC input. The following recommendations will help in selection of the proper location of the controller.

- A tank tee is recommended for mounting the tank, analog pressure transducer, pressure gauge, and pressure relief valve. If a tank tee is not used, the pressure transducer or pressure sensor should be located within 1.8 meters (6 feet) of the pressure tank to minimize pressure fluctuations. There should be no elbows between the tank and pressure transducer or pressure sensor.
- The unit should be mounted on a sturdy supporting structure such as a wall or supporting post. Please take into account the weight of the unit.
- The electronics inside the SubDrive are air-cooled. As a result, there should be at least 15 cm (6 inches) of clearance on each side and below the unit to allow room for air flow.
- The mounting location should have access to 208/230 VAC electrical supply and to the submersible motor wiring. To avoid possible interference with other appliances, please refer to the Wire Routing section of this manual and observe all precautions regarding power cable routing.
- The unit should not be installed in corrosive environments.



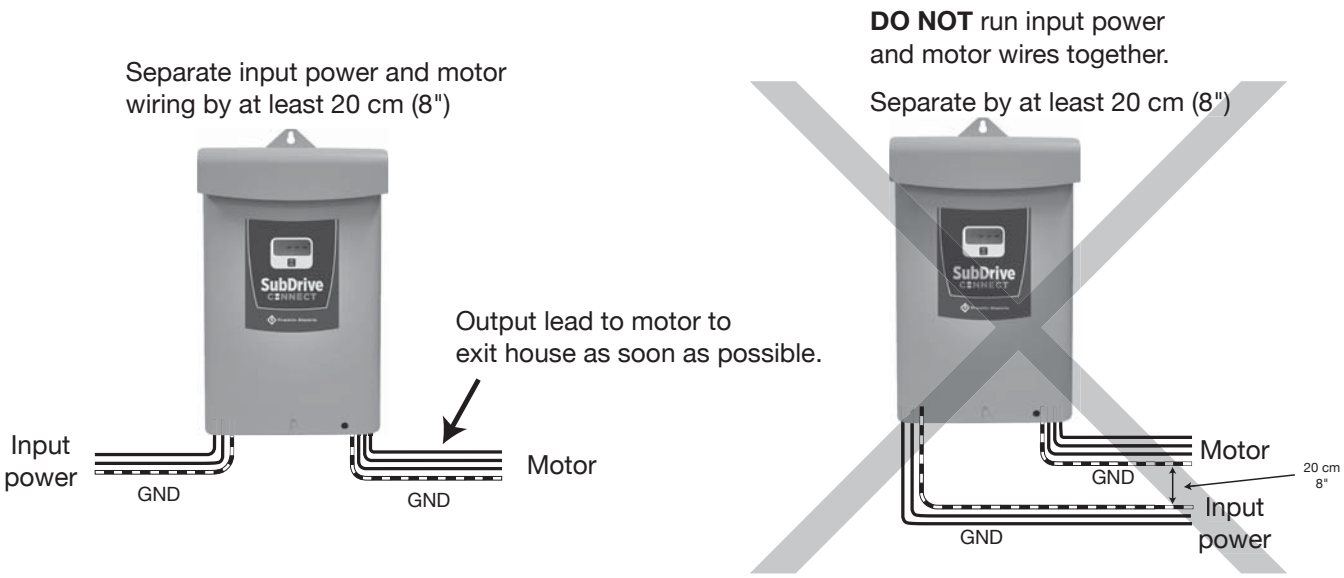
Special Considerations for Outdoor Use

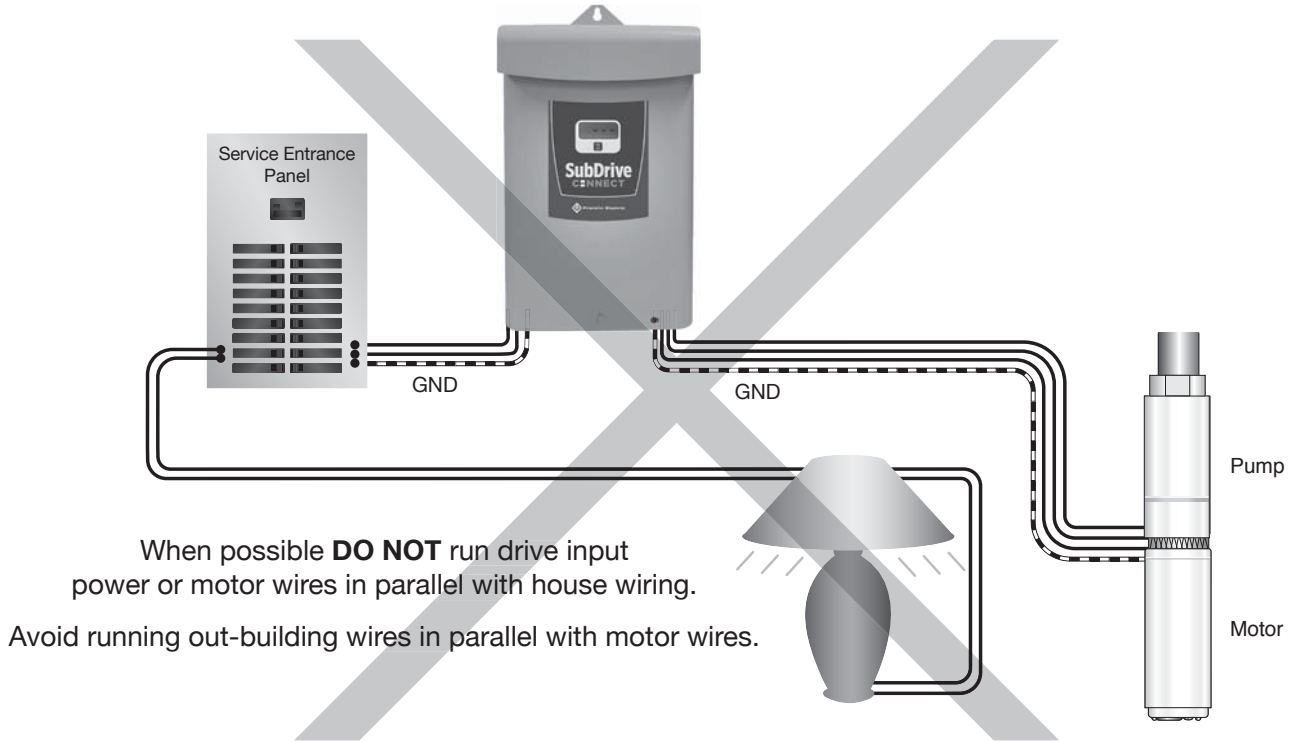
The controller is suitable for outdoor use with a IP 23 rating; however, the following considerations should be made when installing the controller outdoors:

- The unit MUST be mounted vertically with the wiring end oriented downward, and the cover must be properly secured (also applies to indoor installations).
- The controller shall be mounted on a surface or back plate no smaller than the outer dimensions of the controller enclosure.
- IP 23 enclosures are capable of withstanding downward-directed rain only. The controller should be protected from hose-directed or sprayed water as well as blowing rain. Failure to do so may result in controller failure.
- The controller should NOT be placed in direct sunlight or other locations subject to extreme temperatures or humidity.
- Appropriate screening should be used for the air inlet and outlet when installed in areas where insect or small animal intrusion is an issue. See Accessories page for ordering information. Caution: Installation of non-approved screening may damage the drive and/or reduce drive output. Screens should be cleaned on a regular basis to ensure proper airflow needed to cool the controller.

Wire Routing

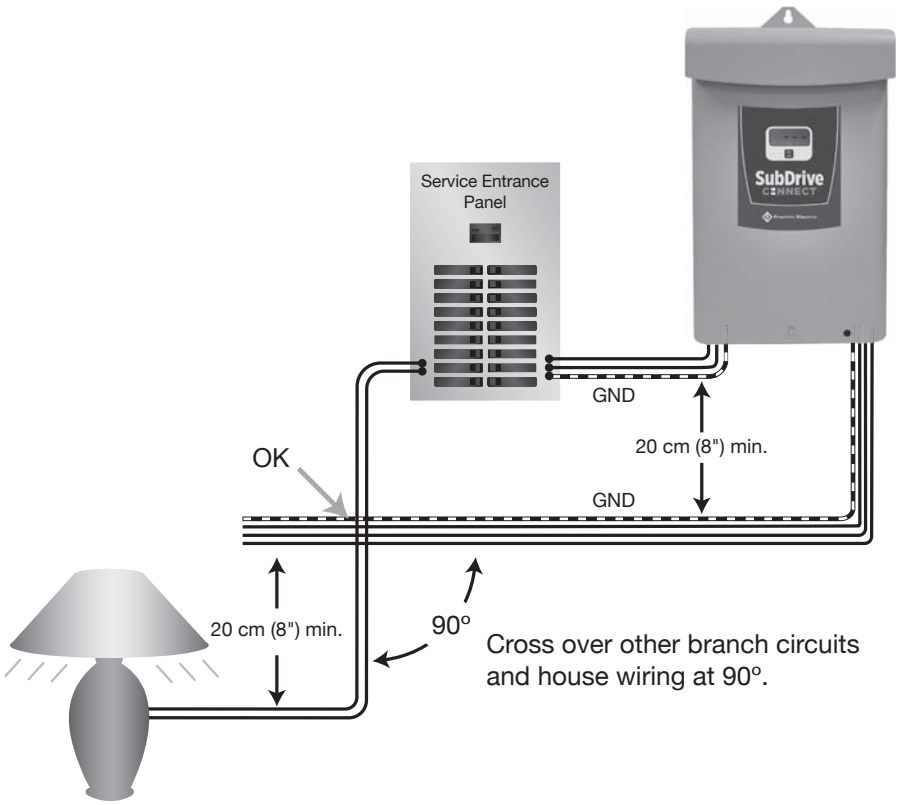
To ensure the best protection from interference with other devices, please observe the following precautions:

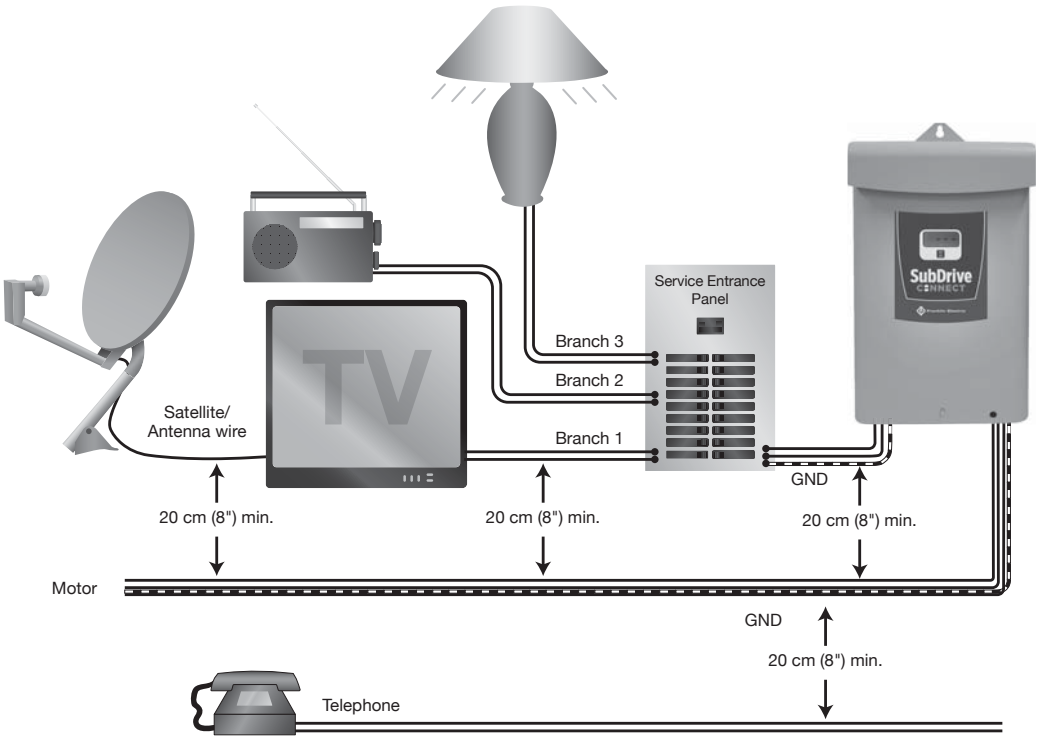




When possible **DO NOT** run drive input power or motor wires in parallel with house wiring.

Avoid running out-building wires in parallel with motor wires.

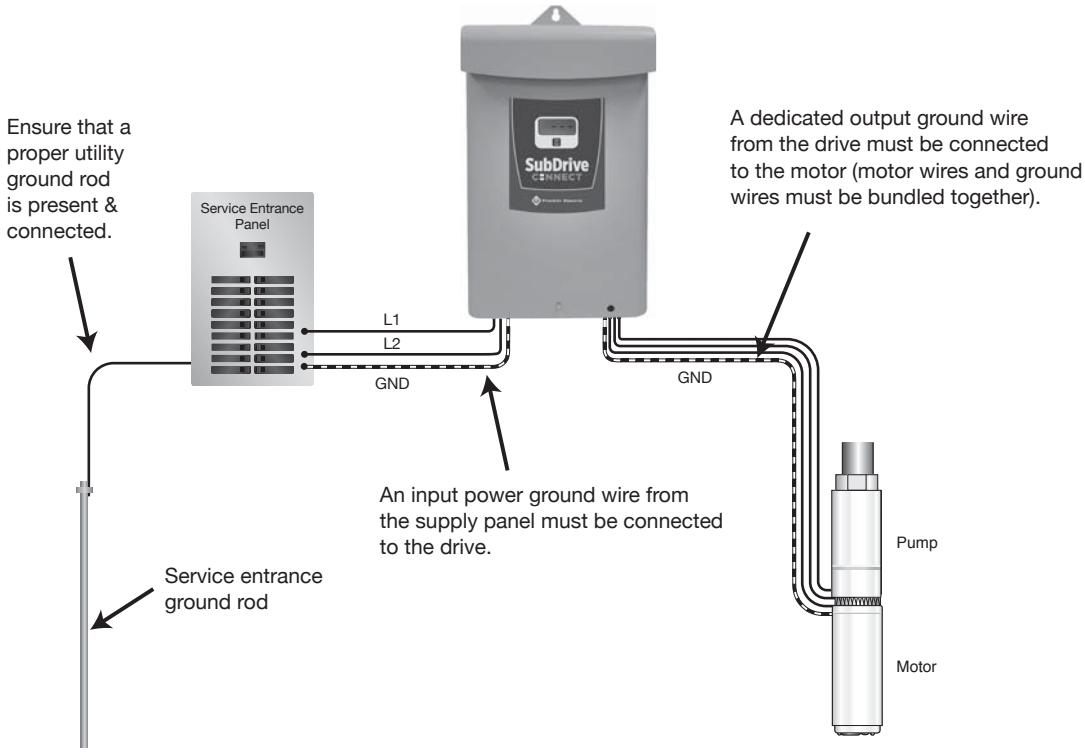


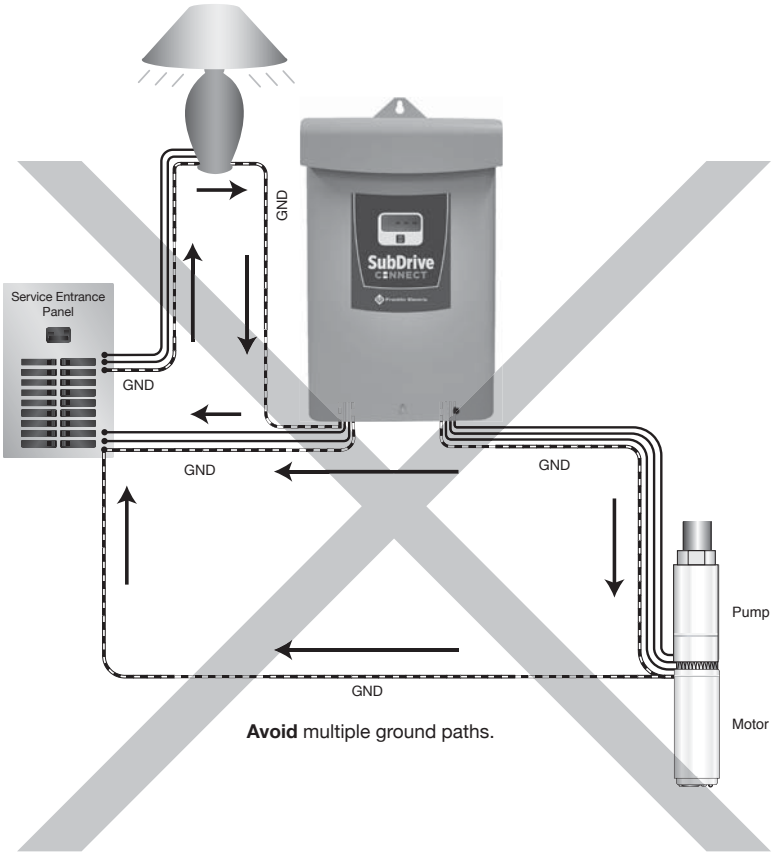


If it is necessary to run wiring in parallel, keep drive input power and motor wires at least 20 cm (8") from other house wiring.

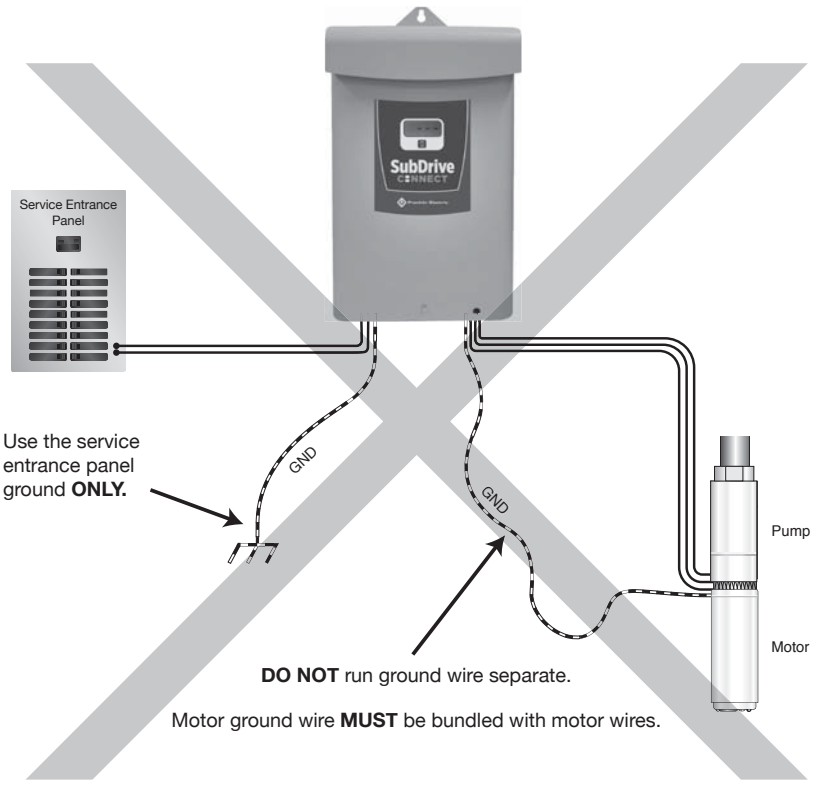
Grounding

To ensure safety and performance, please observe the following grounding requirements:





Avoid multiple ground paths.



Fuse/Circuit Breaker and Wire Sizing

The Listed fuse/Listed circuit breaker size and maximum allowable wire lengths for connection to the SubDrive are given in the following tables:

Table 1: Circuit Breaker Sizing and Maximum Input Cable Lengths (in Meters)
Based on a 3% voltage drop

Model Family	Listed Fuse / Listed Circuit Breaker Amps	Nominal Input Voltage	AWG / IEC (mm²) Copper Wire Sizes, 167 °F (75 °C) Insulation Unless Otherwise Noted									
			14 2.5	12 4	10 6	8 10	6 16	4 25	3 35	2 35	1 50	AWG mm²
SubDrive1100	16	230	29	45	76	117	187	296	366	482	610	-
	16	208	21	33	56	85	137	216	268	353	446	-
	16	230	25	41	68	105	167	263	327	431	547	-
SubDrive1500	20	208	-	-	35	54	86	137	169	222	281	-
	20	230	-	25	42	67	105	167	207	272	344	-
SubDrive2200	25	208	-	-	28	44	71	112	140	184	233	-
	25	230	-	-	35	54	86	138	170	225	284	-

XXXX Highlighted Numbers denote wire with 90 °C (194 °F)insulation only

NOTE: Standard ground fault protection relays (Residual Current Devices - RCDs) will not work with the SubDrive. If their presence is required, only B-type RCDs may be used. However, extensive EMC measures in the drive generate high frequency capacitive currents which may cause RCD nuisance tripping. Refer to IEC 61800-5-1 Annex E for further details on RCD selection.
Standard RCDs used upstream of the SubDrive may fail to offer protection because of the presence of smooth DC risidual currents that can saturate their cores.

Table 2: Maximum Motor Cable Length (in meters*)

Model Family	Franklin Electric Motor Model	kW (hp)	AWG 600V Copper Wire Sizes, 167 °F (75 °C) Insulation					
			14 2.5	12 4	10 6	8 10	6 16	AWG mm²
SubDrive1100 C	234 714 xxxx (60 Hz) 234 754 xxxx (50 Hz)	1.1 (1.5)	200	330	500*	610*	610*	-
SubDrive1500 C	234 715 xxxx (60 Hz) 234 755 xxxx (50 Hz)	1.5 (2.0)	150	250	370*	610*	610*	-
SubDrive 2200 C	234 716 xxxx (60 Hz) 234 756 xxxx (50 Hz)	2.2 (3.0)	100	160	250	420*	610*	-
SubDrive1100 C	214 705 xxxx (60 Hz)	0.37 (0.5)	121	198	310	-	-	-
SubDrive1100 C	214 707 xxxx (60 Hz)	0.55 (0.75)	91	146	231	304	-	-
SubDrive1100/1500/2200 C	214 708 xxxx (60 Hz)	0.75 (1.0)	76	121	192	301	-	-
SubDrive/1500/2200 C	224 700 xxxx (60 Hz)	1.1 (1.5)	57	94	146	234	304	-
SubDrive/1500/2200 C	224 701 xxxx (60 Hz)	1.5 (2.0)	57	76	118	188	295	-

* Depending on application, an additional output filter may be required with these lead lengths. Line reactor for cable runs over 330m eliminates nuisance OL trips due to capacitive discharge currents. If nuisance tripping of OL protection is observed, output filter #255 930 913 must be installed at the motor drive output.

NOTES:

- The use of 600V minimum rated motor cable is required.
- SubDrive models show cable lengths for highest power motor supported by each model.
- Cable lengths above 330m may require an additional output filter (225930913)
- A 3 m (10-foot) section of cable is provided with the SubDrive to connect the analog pressure transducer.
- Maximum allowable wire lengths are measured between the controller and motor.
- Aluminum wires should not be used with the SubDrive.
- All wiring to comply with the National Electrical Code and local codes.
- SubDrive minimum breaker amps may appear to exceed AIM Manual specifications for the motors listed because SubDrive controllers are supplied from a single-phase service rather than three-phase.
- Motor Overload Protection NOTE: The drive electronics provide motor overload protection by preventing motor current from exceeding the maximum Service Factor Amps (SFA). Motor overtemperature sensing is not provided by the drive.
- Flat-jacketed submersible motor cable is recommended. All splices in the motor cable must be properly sealed with the appropriate water tight shrink tubing. Extreme caution must be taken, especially when using non-jacketed motor cable, to avoid damaging or compromising the motor cable insulation during installation or service. Improper splicing or damage to motor cable insulation may expose the conductor(s) to moisture and can produce motor cable failure.

Generator Sizing

Basic generator sizing for the Franklin Electric SubDrive system is 1.5 times the maximum input watts consumed by the drive, rounded up to the next normal-sized generator.

Recommended minimum generator sizes:

SubDrive1100 C = 3500 Watts (3.5 kW)
SubDrive1500 C = 5700 Watts (6 kW)
SubDrive2200 C = 7000 Watts (7 kW)

NOTE: Not to be used on a Ground Fault Circuit Interrupter (GFCI). If using an externally regulated generator, verify that the voltage, Hertz and idle speed are appropriate to supply the drive.

Tank and Pipe Sizing

The SubDrive needs only a small pressure tank to maintain constant pressure. (See table 3. below for recommended tank size.) For pumps rated 45 lpm (12 gpm) or more, a slightly larger tank is recommended for optimum pressure regulation. The SubDrive can also use an existing tank with a much larger capacity.

The pressure tank pre-charge setting should be 70% of the system pressure setting as indicated in Table 4. The minimum supply pipe diameter should be selected not to exceed a maximum velocity of 2.4 m/s (8 ft/sec) (See Table 5 below for minimum pipe diameter).

Table 3: Minimum Pressure Tank Size (Total Capacity)

Pump Flow Rating	Controler Model	Minimum Tank Size
Less than 45.4 lpm (12 gpm)	SubDrive1100	18 liters
	SubDrive1500	18 liters
	SubDrive2200	18 liters
45.4 lpm (12 gpm) and higher	SubDrive1100	18 liters
	SubDrive1500	30 liters
	SubDrive2200	30 liters

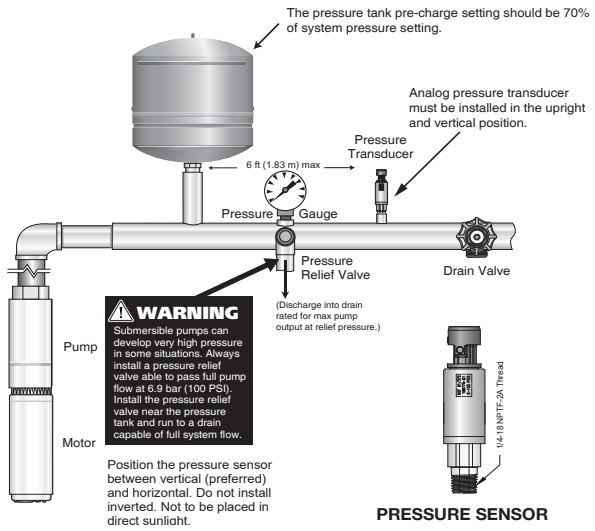
Table 4

Pressure Setting Guide	
Pressure Sensor Set Point (bar)	**Pressure Tank Pre-charge (± 0,1 bar)**
0.3	0.2
0.7	0.5
1.0	0.7
1.4	1
1.7	1.2
2.1	1.5
2.4	1.7
2.8	2
3.1	2.2
3.4	2.4
3.8	2.7
4.1	2.9
4.5	3.2
4.8	3.4
5.2	3.6
5.5	3.9
5.9	4.1
6.2	4.3
6.6	4.6

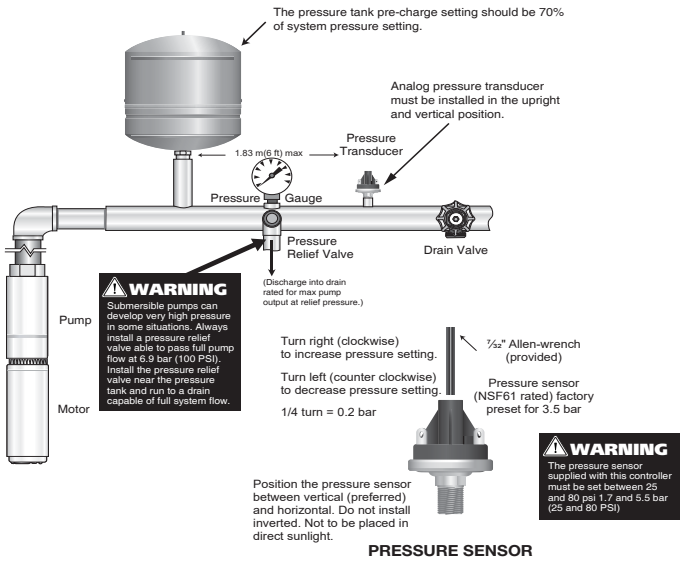
Table 5

Maximum Velocity 2,4 m/s (8 ft/s)	
Min Pipe Dia	**max³/h**
1/2"	1,1
3/4"	2,5
1"	4,5
1-1/4"	7,0
1-1/2"	10,0
2"	17,8
2-1/2"	40,0

SubDrive Connect System with analogue pressure transducer (included in set)



SubDrive Connect System with pressure sensor



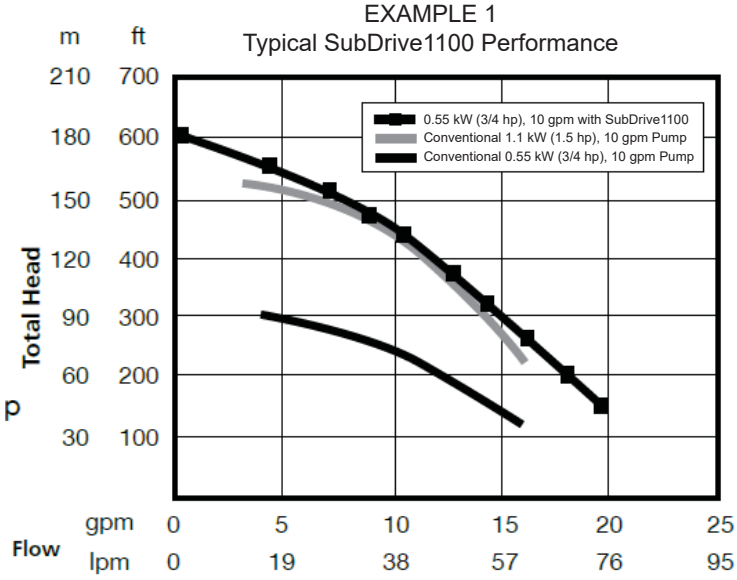
Pump Sizing and Performance

SubDrive1100

The SubDrive1100 is capable of use with 0.55 kW (3/4 hp) pumps that are mounted to 1.1 kW (1.5 hp) Franklin Electric three-phase motors. In general, the SubDrive1100 will enhance the performance of a 0.55 kW (3/4 hp) pump to a similar or better performance than a conventional 1.1 kW (1.5 hp) pump of the same flow rating (pump series).

To select the proper 0.55 kW (3/4 hp) pump, first choose a 1.1 kW (1.5 hp) curve that meets the application's head and flow requirements. Use the 0.55 kW (3/4 hp) pump in the same pump series (flow rating). The SubDrive1100 will adjust the speed of this pump to produce the performance of the 1.1 kW (1.5 hp) curve. An EXAMPLE of this is illustrated in the graph at right. Please consult the pump manufacturer's pump curve for your specific application.

EXAMPLE 1
Typical SubDrive1100 Performance



The SubDrive1100 can also be set up to run a 0.75 kW (1.0 hp) or 1.1 kW (1.5 hp) pump if desired, but larger pumps will still produce to the 1.1 kW (1.5 hp) curve and may only be operated with a 1.1 kW (1.5 hp) motor. To operate a different pump size, a DIP switch must be positioned to select the correct pump rating. Otherwise, the SubDrive1100 may trigger erroneous faults.

See the Basic Set-up section of this manual for DIP switch information and settings.

⚠ WARNING

Serious or fatal electrical shock may result from contact with internal electrical components. DO NOT, under any circumstances, attempt to modify DIP switch settings until power has been removed and 5 minutes have passed for internal voltages to discharge! Power must be removed for DIP switch setting to take effect.

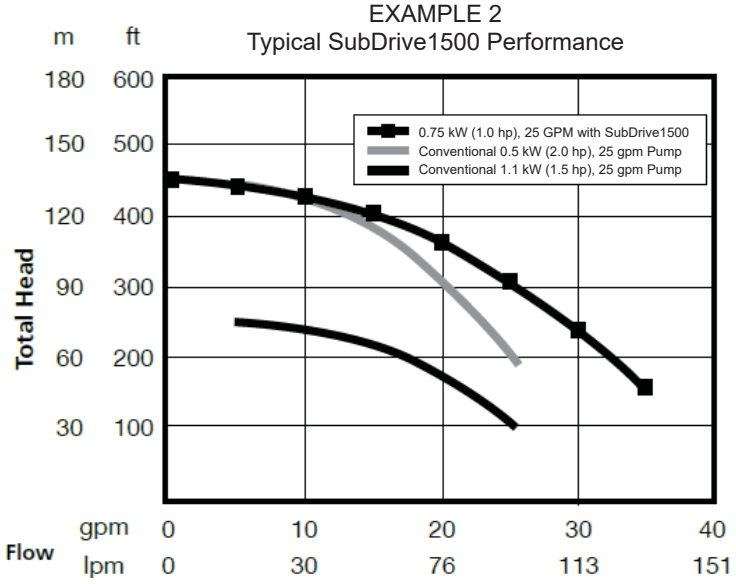
SubDrive1500

The SubDrive1500 is capable of use with 0.75 kW (1.0 hp) pumps that are mounted to 1.5 kW (2.0 hp) Franklin Electric three-phase motors. In general, the SubDrive1500 will enhance the performance of a 0.75 kW (1.0 hp) pump to a similar or better performance than a conventional 1.5 kW (2.0 hp) pump of the same flow rating (pump series).

To select the proper 0.75 kW (1.0 hp) pump, first choose a 1.5 kW (2.0 hp) curve that meets the application's head and flow requirements. Use the 0.75 kW (1.0 hp) pump in the same pump series (flow rating). The SubDrive1500 will adjust the speed of this pump to produce the performance of the 1.5 kW (2.0 hp) curve.

An EXAMPLE of this is illustrated in the graph at right. Please consult the pump manufacturer's pump curve for your specific application.

EXAMPLE 2
Typical SubDrive1500 Performance



The SubDrive1500 can also be set up to run a 1.1 kW (1.5 hp) or 1.5 kW (2.0 hp) pump if desired, but larger pumps will still produce to the 1.5 kW (2.0 hp) curve and may only be operated with a 1.5 kW (2.0 hp) motor. To operate a different pump size, a DIP switch must be positioned to select the correct pump rating. Otherwise, the SubDrive1500 may trigger erroneous faults.

See the Basic Set-up section of this manual for DIP switch information and settings.

⚠ WARNING

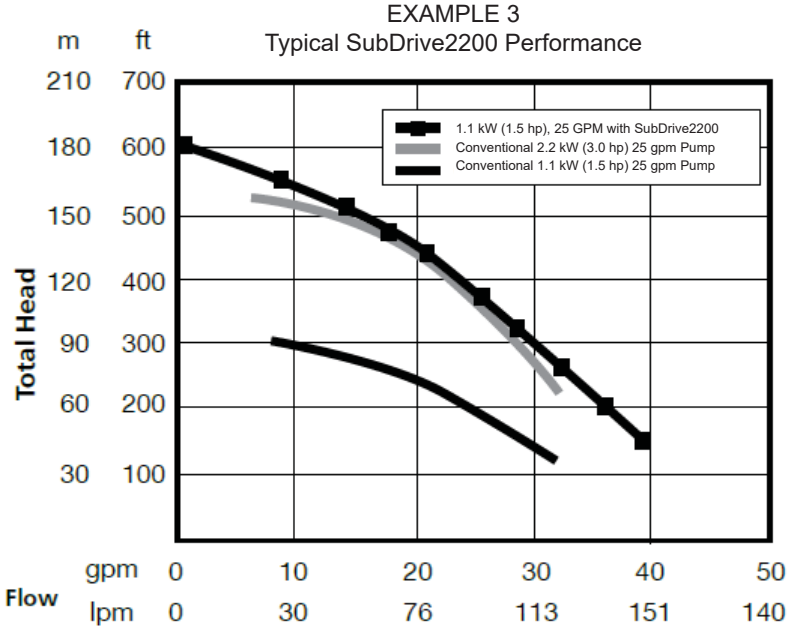
Serious or fatal electrical shock may result from contact with internal electrical components. DO NOT, under any circumstances, attempt to modify DIP switch settings until power has been removed and 5 minutes have passed for internal voltages to discharge! Power must be removed for DIP switch setting to take effect.

SubDrive2200

The SubDrive2200 is capable of use with 1.1 kW (1.5 hp) pumps that are mounted to 2.2 kW (3.0 hp) Franklin Electric three-phase motors. In general, the SubDrive2200 will enhance the performance of a 1.1 kW (1.5 hp) pump to a similar or better performance than a conventional 2.2 kW (3.0 hp) pump of the same flow rating (pump series).

To select the proper 1.1 kW (1.5 hp) pump, first choose a 2.2 kW (3.0 hp) curve that meets the application's head and flow requirements. Use the 1.1 kW (1.5 hp) pump in the same pump series (flow rating). The SubDrive2200 will adjust the speed of this pump to produce the performance of the 2.2 kW (3.0 hp) curve. An EXAMPLE of this is illustrated in the graph at right. Please consult the pump manufacturer's pump curve for your specific application.

EXAMPLE 3
Typical SubDrive2200 Performance



The SubDrive2200 can also be set up to run a 1.5 kW (2.0 hp) or 2.2 kW (3.0 hp) pump if desired, but larger pumps will still produce to the 2.2 kW (3.0 hp) curve and may only be operated with a 2.2 kW (3.0 hp) motor. To operate a different pump size, a DIP switch must be positioned to select the correct pump rating. Otherwise, the SubDrive2200 may trigger erroneous faults.

See the Basic Setup section of this manual for DIP switch information and settings.

⚠ WARNING
Serious or fatal electrical shock may result from contact with internal electrical components. DO NOT, under any circumstances, attempt to modify DIP switch settings until power has been removed and 5 minutes have passed for internal voltages to discharge! Power must be removed for DIP switch setting to take effect.

SubDrive1100 - MonoDrive Functionality*

The MonoDrive is designed to convert a conventional (60 Hz) 0.37 kW (1/2 hp), 0.55kW (3/4 hp) or 0.75kW (1.0 hp) pump system to a variable speed constant pressure system by simply replacing the 3-wire control box and pressure switch. Maximum pump output using the MonoDrive is similar to the performance achieved using a conventional control box. Therefore, the pump selection criteria are the same as if a control box were used. Please refer to the pump manufacturer's literature for details of the pump selection procedure.

If a pump and motor, as described above, are already installed in the system and the well system components are in good working order, no further system upgrades are required. However, if the existing pump and motor have not been properly chosen, or if the components of the well system are not in good working order, the MonoDrive cannot be used to correct the problem or extend the life of aging components.

Failure to match the configuration to the rating of the pump and motor may trigger erroneous faults. See the Basic Set-up section of this manual for DIP switch information and settings.

SubDrive1500 / 2200 - MonoDriveXT Functionality*

The MonoDriveXT is designed to convert a conventional (60 Hz) 0.75kW (1.0 hp), 1.1 kW (1.5 hp) or 1.5 kW (2.0 hp) pump system to a variable speed constant pressure system by simply replacing the 3-wire control box and pressure switch. Maximum pump output using the MonoDriveXT is similar to the performance achieved using a conventional control box. Therefore, the pump selection criteria are the same as if a control box were used. Please refer to the pump manufacturer's literature for details of the pump selection procedure.

If a pump and motor, as described above, are already installed in the system and the well system components are in good working order, no further system upgrades are required. However, if the existing pump and motor have not been properly chosen, or if the components of the well system are not in good working order, the MonoDriveXT cannot be used to correct the problem or extend the life of aging components.

Failure to match the configuration to the rating of the pump and motor may trigger erroneous faults. See the Basic Set-up section of this manual for DIP switch information and settings.

Notes:

*Currently only availabe for 60Hz Motors.

Installation Procedure

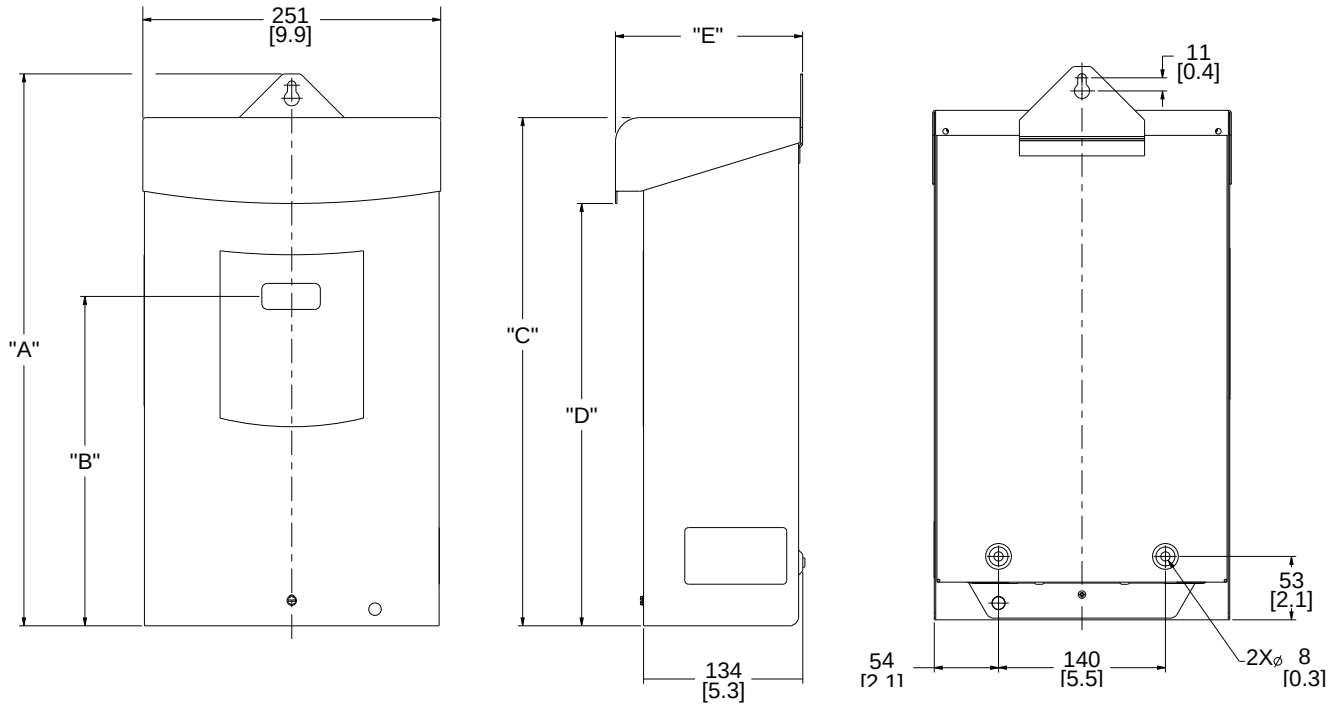
Drive Mounting

The SubDrive unit should be mounted on a surface or backplate no smaller than the outer controller dimensions in order to maintain the IP 23 rating. The controller must be mounted at least 46 cm (18") off the ground.

The controller is mounted using the hanging tab on the top side of the enclosure, as well as two (2) additional mounting holes on the back side of the controller. All three (3) screw hole locations should be used to ensure the controller is securely mounted to the backplate or wall.

MODEL	"A"	"B"	"C"	"D"	"E"
SubDrive1100	464 [18.3]	355 [14.0]	455 [17.9]	427 [16.8]	157 [6.2]
SubDrive1500 SubDrive2200	539 [21.2]	430 [16.9]	530 [20.9]	503 [19.8]	157 [6.2]

mm [in]



Drive Wiring

⚠ WARNING

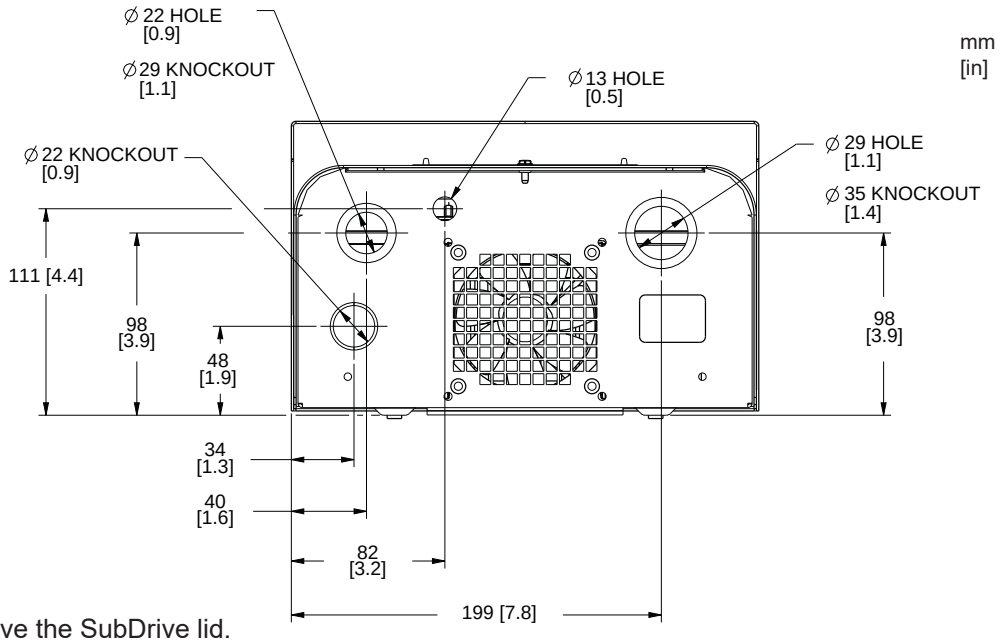
Serious or fatal electrical shock may result from failure to connect the motor, the SubDrive, metal plumbing, and all other metal near the motor or cable to the power supply ground terminal using wire no smaller than motor cable wires. To reduce risk of electrical shock, disconnect power before working on or around the water system. Do not use motor in swimming areas.

NOTE: Ensure that the system is properly grounded all the way to the service entrance panel. Improper grounding may result in the loss of voltage surge protection and interference filtering.

1. Verify that the power has been shut off at the main breaker.

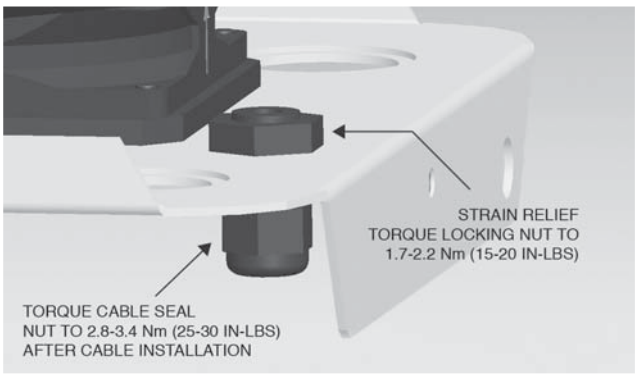
2. Verify that the dedicated branch circuit for the SubDrive is equipped with a properly-sized circuit breaker. (See Table 1, pg. 20 for minimum breaker size.)

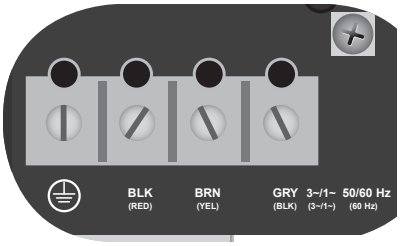
3. Use appropriate strain relief or conduit connectors. See below for conduit hole and knockout sizes.



4. Remove the SubDrive lid.

5. Feed the motor leads through the opening on the bottom right side of the unit and connect them to the terminal block positions marked ⏚ (Green/Yellow Ground Wire), [BLK(RED)], [BRN/(YEL)], [GRY/(BLK)]. Tighten terminals to 1.7 Nm (15 in-lbs).



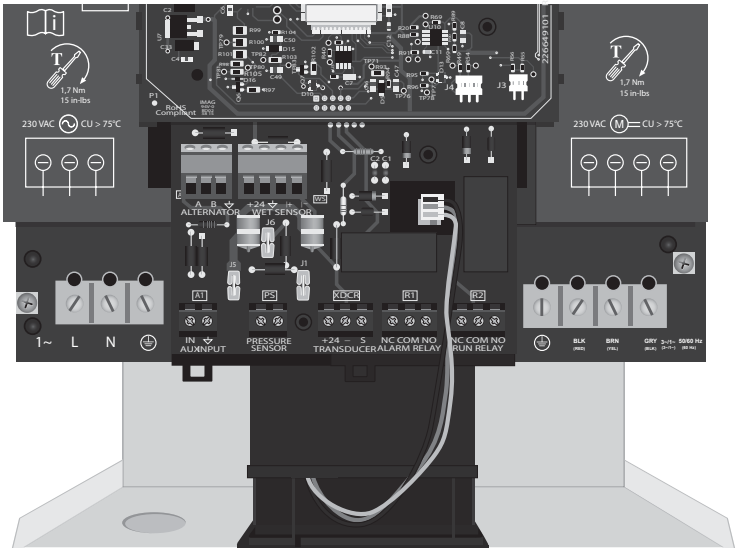


⚠ CAUTION

For retrofit application, make sure to check integrity of power and motor leads.
This requires measuring the insulation resistance with the suitable megohmmeter.
* See AIM Manual for specifications.

6. Feed the 230 VAC power leads through the larger opening on the bottom left side of the SubDrive controller and connect them to the terminals marked L, N, and ⏚. Tighten terminals to 1.7 Nm (15 in-lbs).

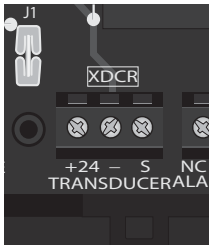
7. For analog pressure transducer or pressure sensor leads, use the smaller opening on the bottom of the SubDrive unit (to the right of the input power leads).



For Analog Pressure Transducer

NOTE: A 3 m (10 foot) section of pressure transducer cable is provided with the controller. Other lengths are available. See Accessories section for ordering information.

a. Locate the terminal block labeled TRANSDUCER (XDCR).
b. Connect the RED lead of the pressure transducer cable to the +24 terminal of the XDCR terminal block.
c. Connect the BLACK lead of the pressure transducer cable to the - terminal.
d. Connect the bare shield lead of the pressure transducer cable to the S terminal (where applicable).
e. Tighten terminals to 0.6 Nm (5 in-lbs) with a small screwdriver (provided).
f. Torque the fitting as shown in the figure to the right.

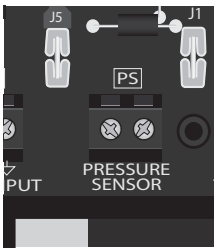


For SubDrive Pressure Switch

⚠ CAUTION

When increasing the pressure, do not exceed the mechanical stop on the pressure sensor or 5.5 bar (80 PSI). The pressure sensor may be damaged.

a. Locate the terminal block labeled PRESSURE SENSOR (PS).
b. Connect the red and black leads (interchangeable) of the pressure sensor cable to the terminals of the PS terminal block on the Pressure Input Board.
c. Tighten terminals to 0.55 Nm (5 in-lbs) with a small screwdriver (provided).
d. Torque the fitting as shown in the figure to the right.



NOTE: A 3 meter (10-foot) section of pressure sensor cable is provided with the controller, but it is possible to use similar 0.32 mm² (22 AWG) wire for distances up to 30 meters (100 feet) from the pressure sensor. A 30 meters (100 feet) section of pressure sensor cable is available from your local Franklin Electric distributor. Low capacitance cable must be used if the pressure sensor is being connected with cable not supplied by Franklin Electric. Cable length longer than 30 meters (100 feet) should not be used as it can cause the drive to operate incorrectly. (See Accessories section on page 39 for details.)

8. Verify that the SubDrive unit is properly configured for the horsepower rating of the motor and pump being used. (See the Pump Sizing section on page 23 for information on Drive Configuration.)

9. Verify that the SubDrive is correctly configured for the pressure sensor type being used.

10. Replace the cover. Tighten screw to 1.1 Nm (10 in-lbs).

11. Connect the other end of the pressure sensor cable with the two spade terminals to the pressure sensor. The connections are interchangeable.

12. Set the pressure tank pre-charge at 70% of the desired water pressure setting. To check the tank's pre-charge, de-pressurize the water system by opening a tap with the drive off. (See Table 4 on page 22.)

Measure the tank pre-charge with a pressure gauge at its inflation valve and make the necessary adjustments.

Additional Control Input/Output Wiring

Built-In Duplex Alternator

The ALTERNATOR terminal supports the built-in Duplex Alternator function of the SubDrive Connect controllers. An appropriate Duplex Alternator communication cable should be used to make the connection between both controllers using this terminal. This Duplex Alternator cable leads should be wired to this terminal as follows:

(A): Black (same for both drives) (B): Red (same for both drives) (⏚): Green

Both drives using the built-in Duplex Alternator function should be wired from the same sub-panel to ensure proper communication and operation. See the Accessories section for Duplex Alternator cable ordering information.

Moisture Sensor

The WET SENSOR terminal supports the Franklin Electric Moisture Sensor. The Moisture Sensor leads should be wired to this terminal as follows:

(+24): Red (⏚): Black (I+): White (I-): Green

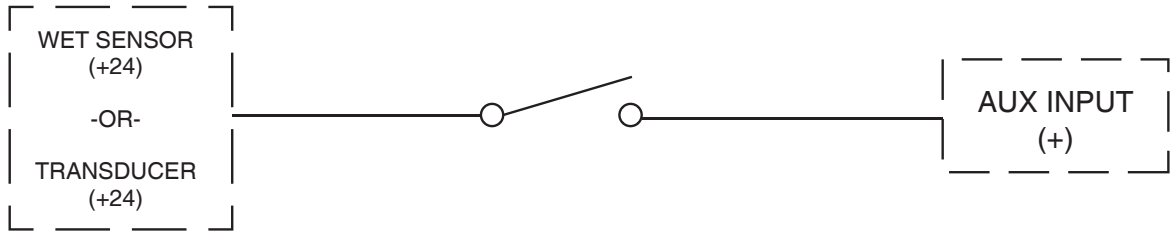
The (I+) and (I-) terminals accept an unpowered dry contact relay input and can be used with other external control switches. Refer to the Advanced Setup section for more information about configuring this input. See the Accessories section for Moisture Sensor kit ordering information.

Auxiliary Input

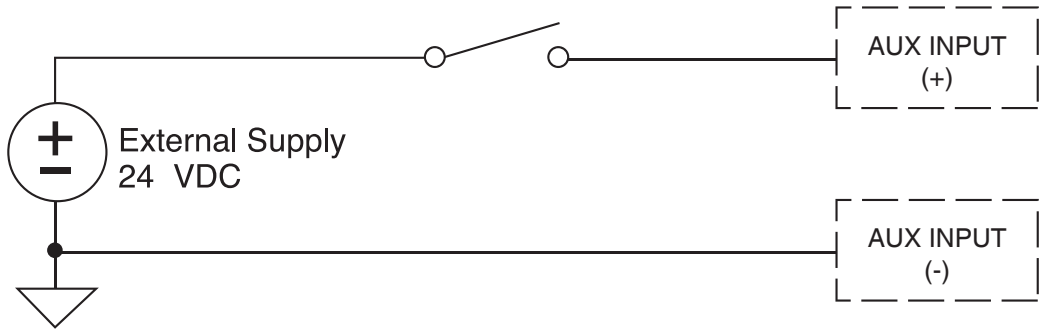
The AUX IN terminal supports a dry-contact 24 VDC digital input to control the SubDrive unit. This terminal can be wired using the internal 24 VDC supply or an external 24 VDC supply. When using an external 24 VDC supply, the signal common of the external supply must be connected to the AUX INPUT (-) terminal of the SubDrive controller.

(+): 24 VDC switched input (-): Signal Common for 24 VDC signal

Internal 24 VDC Supply



External 24 VDC Supply



Refer to the Advanced Setup section for more information about configuring this input.

Drive Configuration

⚠ CAUTION

Serious or fatal electrical shock may result from contact with internal electrical components. DO NOT, under any circumstances, attempt to modify DIP switch settings until power has been removed and 5 minutes have passed for internal voltages to discharge! Power must be removed for DIP switch setting to take effect.

Basic Setup (DIP Switches)

For basic set-up, DIP SW1 Position 1 (FE Connect switch) must be in the “OFF” (down) position for DIP switch, Pressure Setpoint Potentiometer, and Underload Potentiometer settings to be recognized.

Motor Type Selection (DIP SW1 - Position 2)

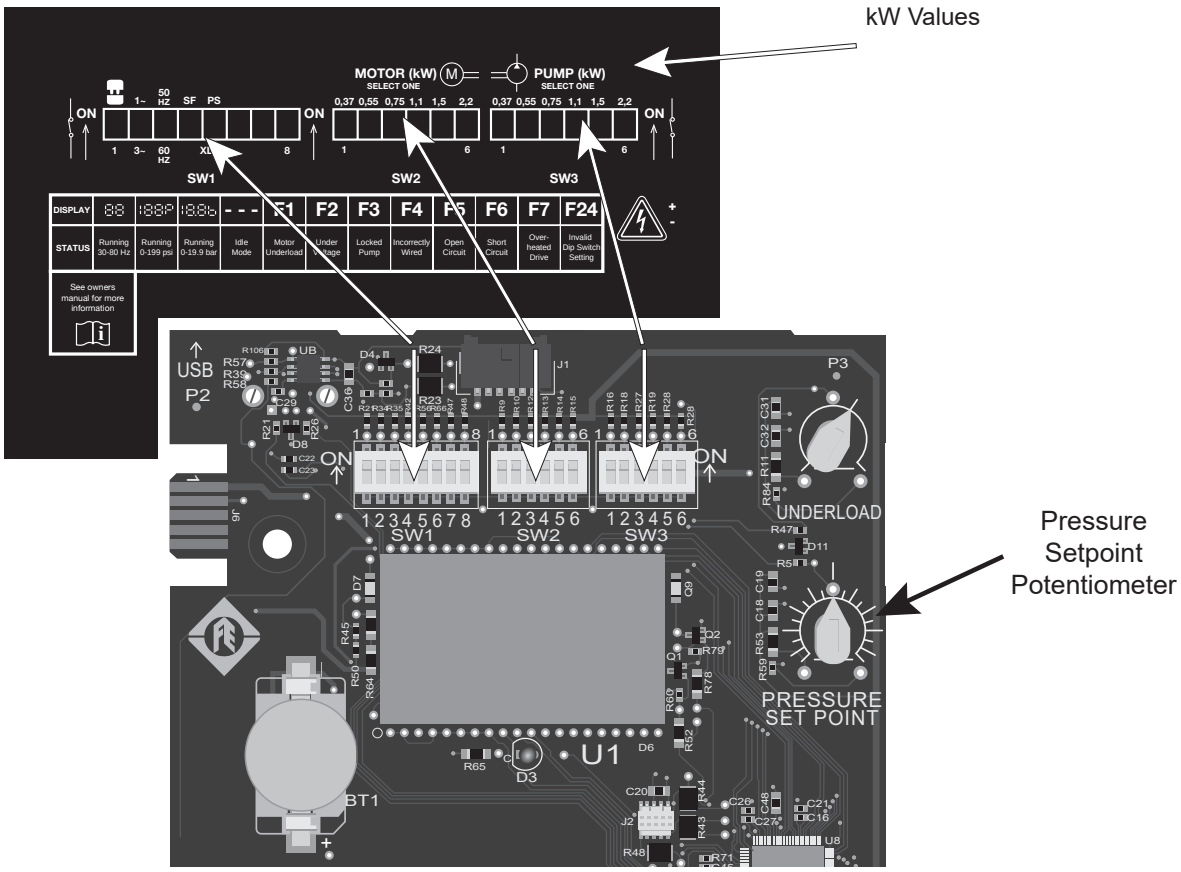
SubDrives have the ability to perform as MonoDrives when needed (SubDrive1100 can be set as a MonoDrive. SubDrive1500 and SubDrive2200 units can be set as a MonoDrive or MonoDriveXT). If you wish to operate a single-phase motor with a SubDrive unit, ensure that DIP SW1 Position 2 is in the “ON” (up) position This is indicated by “1~” printed above DIP SW1 Position 2 on the black shield. If using a SubDrive with a three-phase motor, ensure DIP SW1 Position 2 is in the “OFF” (down) position, which is indicated by “3~” printed below DIP SW1 Position 2 on the black shield (this is the default setting for SubDrive units).

NOTE: When operating a SubDrive as a MonoDrive, please refer to the specifications on page 41.

Motor / Pump Size (DIP SW2 and DIP SW3 - Positions 1-6)

The SubDrive can be configured to operate by setting only two (2) DIP switches; one (1) for the motor size and one (2) for the pump size. The DIP switches are located on the top of the User Interface board as shown in the figure below.

NOTE: When operating a SubDrive as a MonoDrive, please refer to the specifications on page 41.



Select the one (1) DIP switch from SW2 that corresponds to the motor kW being used and one (1) DIP switch from SW3 that corresponds to the pump kW being used. The corresponding kW values are printed above the SW2 and SW3 diagrams on the black shield. Selecting none or more than one switch in either SW2 or SW3 will result in an Invalid DIP Switch Fault indicated by F24 on the display.

Pressure Sensor Selection (DIP SW1 - Position 5)

A 10 bar analog pressure transducer is included with the controller. Ensure that the controller is properly configured for the type of pressure sensor being used. The PS/XDCR DIP Switch (DIP Switch 1 – Position 5) must be in the XDCR (down) position when using an analog pressure transducer. The switch must be in the PS (up) position when using a traditional SubDrive pressure sensor.

Pressure Setpoint (requires analog pressure transducer)

For Analog Pressure Transducer
The Pressure Setpoint MUST be adjusted only when the SubDrive is POWERED OFF. The new setting will not take effect until the drive is powered up.

When using the 10 bar analog pressure transducer, the desired system pressure is set by using the pressure setpoint adjustable knob (see figure above). The knob is factory set to 5 bar and is adjustable from 0.5 to 9.5 bar (7.3 - 137.8 PSI) in 0.5 bar (7.3 PSI) increments. Refer to the indicator lines surrounding the switch and the corresponding legend printed on the shield when setting the desired pressure setpoint.

NOTE: This knob is only compatible with the default 4-20mA 10 bar analog pressure transducer. If using an analog pressure transducer with a different range, the FE Connect DIP switch (DIP Switch 1 – Position 1) must be in the ON/UP position and the Pressure Transducer Type, Pressure Transducer Range, and Pressure Setpoint parameters must be configured using the FE Connect mobile app. Refer to the Advanced Setup section for more information.

For SubDrive Pressure Sensor
The pressure sensor communicates the system pressure to the SubDrive controller. The sensor is preset at the factory to 3.4 bar (50 psi), but can be adjusted by the installer using the following procedure:

a. Remove the rubber end-cap.

b. Using a 7/32" Allen-wrench (provided), turn the adjusting screw clockwise to increase pressure and counter-clockwise to decrease pressure. The adjustment range is between 1.7 and 5.5 bar (25 and 80 psi). NOTE: 1/4 turn = approximately 0.2 bar (3 psi).

c. Replace the rubber end cap.

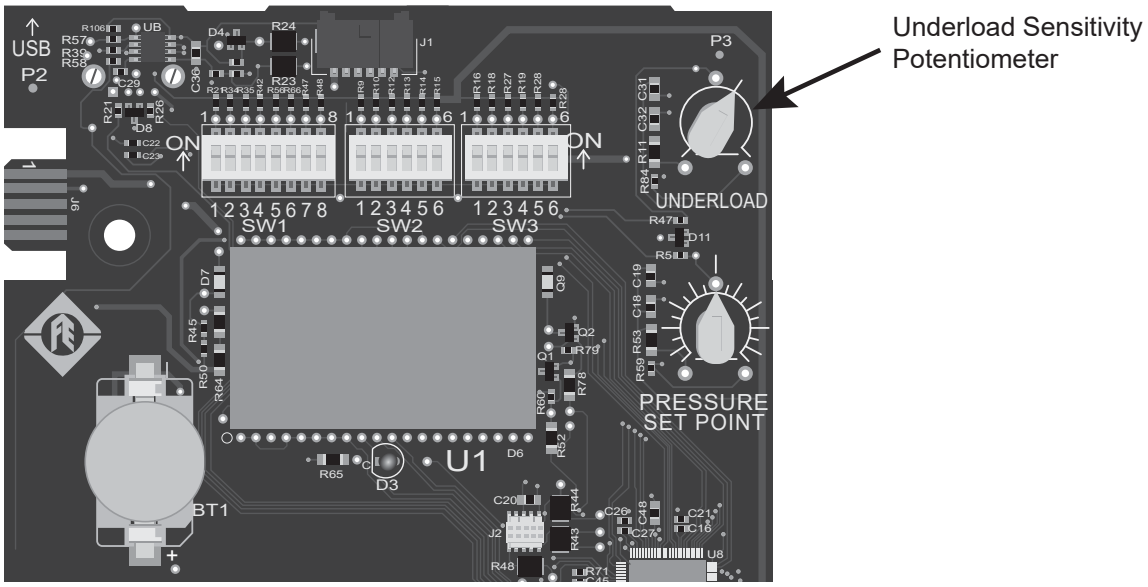
d. Cover the pressure sensor terminals with the rubber boot provided. Do not place boot in direct sunlight.

Underload Sensitivity (if needed)

The Underload Sensitivity MUST be adjusted only when the SubDrive is POWERED OFF. The new setting will not take effect until the drive is powered up.

The SubDrive controller is configured at the factory to ensure detection of Underload faults in a wide variety of pumping applications. In rare cases (as with certain pumps in shallow wells) this trip level may result in nuisance faults. If the pump is installed in a shallow well, activate the controller and observe system behavior. Once the controller begins to regulate pressure, check operation at several flow rates to make sure the default sensitivity does not induce nuisance Underload trips.

If it becomes necessary to desensitize the Underload trip level, remove power and wait five minutes for the controller to discharge. Once the internal voltages have dissipated, locate the Underload Potentiometer on the upper-right corner of the User Interface Board as shown in the figure on the next page.



Underload Sensitivity: Shallow Set

If the pump is installed in an extremely shallow (i.e. artesian) well and the system continues to trip, then the Underload Potentiometer (Pot) will need to be adjusted counter-clockwise to a lower sensitivity setting. Check the Underload trip level and repeat as necessary.

Underload Sensitivity: Deep Set

In cases where the pump is set very deep, run the system at open discharge to pump the well down and observe carefully that an Underload is detected properly. If the system does not trip as it should, then the Underload Pot will need to be adjusted clockwise to a higher sensitivity setting.

If necessary to adjust the Underload Sensitivity, remove power and allow the controller to discharge. Wait 5 minutes to allow internal voltage to dissipate, locate the Underload Sensitivity knob, and make necessary adjustments.

Steady Flow Selection (DIP SW1 - Position 4)

The SubDrive controller is configured at the factory to ensure quick response to maintain constant pressure. In rare cases (as with a water line tap before the pressure tank), the controller may need to be adjusted to offer better control.

If the controller is used on a system that has a water line tapped before the pressure tank and close to the well head or where audible speed variations of the PMA can be heard through the pipes, adjusting the pressure control response time may be necessary. After enabling this feature, the installer should check flow and pressure changes for possible overshoot. A larger pressure tank and/or wider margin between regulation and pressure relief valve pressure may be required as the Steady Flow feature reduces the controller's reaction time to sudden changes in flow.

If it is necessary to adjust the pressure control, remove power and allow the controller to discharge. Wait 5 minutes to allow internal voltage to dissipate, locate the DIP switch marked "SW1". Move DIP SW1 Position 4 to "ON" (up) position.

⚠ WARNING
Serious or fatal electrical shock may result from contact with internal electrical components. DO NOT, under any circumstances, attempt to modify DIP switch settings until power has been removed and 5 minutes have passed for internal voltages to discharge! Power must be removed for DIP switch setting to take effect.

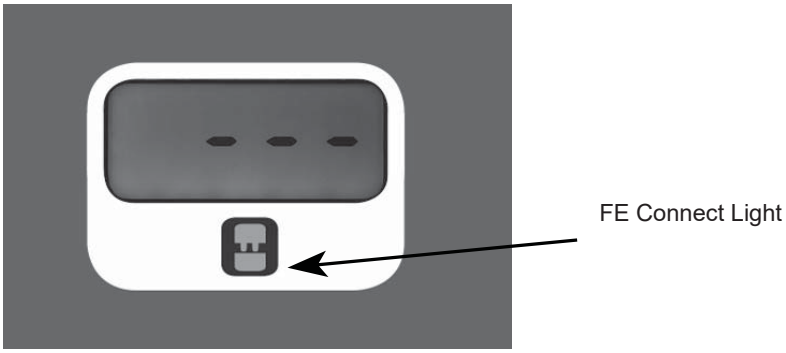
Advanced Setup (Wi-Fi / FE Connect Mobile App)

Some advanced features are able to be modified when connected to the SubDrive through Wi-Fi and using the FE Connect mobile app. Follow the instructions below to connect to the drive and access these advanced settings and features.

Connecting to Wi-Fi

1. The drive's Wi-Fi radio is only able to be connected to within fifteen (15) minutes following a power-up. If the drive has been powered on for longer than fifteen (15) minutes, cycle power to the SubDrive unit.

2. After a few seconds of initialization following power-up, the FE Connect light will illuminate solid to indicate that a connection is available. If the FE Connect light is flashing, a previously-connected device is within range of the drive and is attempting to connect. The FE Connect light is located just below the clear window of the display.



3. Open the Wi-Fi connection settings on the device you wish to use to connect to the drive. This is similar to the method used to connect to a normal Wi-Fi hotspot. In the list of available Wi-Fi connections locate the hotspot named "FECNCT_XXXXX", where "XXXXX" is the ending portion of the serial number of the drive being connected to.

4. Connect to the Wi-Fi hotspot. The FE Connect light on the drive will flash to indicate that a connection is being made. Only one (1) device can be connected to a drive at any given time.

   NOTE: The Wi-Fi connection will stay active for an unlimited amount of time as long as the mobile device is not disconnected from the drive Wi-Fi. If the connection is broken, the drive Wi-Fi will be available for reconnection for one (1) hour following a disconnection. If you wish to reconnect to the drive Wi-Fi after an hour has elapsed, the drive must be power cycled.

Accessing the Drive

After making a successful connection to the drive, launch the FE Connect mobile app. The FE Connect mobile app can be downloaded from the Apple App Store or Google Play depending on the device being used.

Set-up

The Set-up screen allows for the set-up of additional features of the drive including:

- Drive Output*
- Motor Size*
- Pump Size*
- Underload Sensitivity*
- Underload Off Time
- Minimum Frequency
- Maximum Frequency
- Pressure Sensor Type*
- Pressure Transducer Range*
- Pressure Set Point*
- Drawdown / Cut-in Pressure
- Duplex Alternator Functionality*
- Moisture Sensor
- Bump Mode
- Large Tank Mode
- Aggressive Bump
- Broken Pipe Detection
- Steady Flow*
- Units (hp or kW)

* In order to change and use settings from this page for the Drive Output, Motor Size, Pump Size, Underload Sensitivity, Pressure Sensor Type, Pressure Transducer Range, Pressure Set Point, Duplex Alternator Functionality, and Steady Flow, the FE Connect DIP switch (SW1, Position 1) on the drive must be “ON”. Otherwise, the drive will default to the settings made via the DIP switches and Underload Sensitivity and Pressure Set Point rotary knobs on the drive itself.

The Pressure Control portion of the Setup screen allows for configuration of the Sensor Type, Transducer Range, Primary Setpoint, and Drawdown functions.

Pressure Control: Sensor Type

This parameter sets which pressure sensor type to use: Switch, Transducer (PSI), or Transducer (bar).
Default: Transducer (bar)

Pressure Control: Transducer Range

When using a pressure transducer, this parameter sets the range of the transducer connected to the drive.
Default: 10 (bar) Minimum: 6 (bar) Maximum: 16 (bar)

Pressure Control: Primary Setpoint

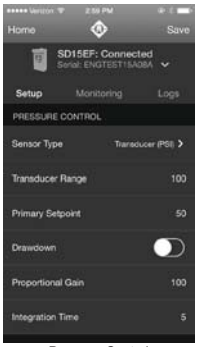
When using a pressure transducer, this parameter sets the system pressure set point that the controller will regulate to.
Default: 3.5 (bar) Minimum: 0.5 (bar)
Maximum: (Pressure Transducer Range) – 0.5 (bar)

Pressure Control: Drawdown

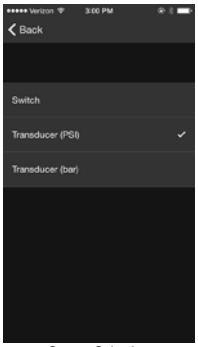
This selection enables or disables the drawdown function. Drawdown allows the drive to regulate to the Pressure Setpoint and remain off until the Cut In Setpoint is reached.

Pressure Control: Cut In Setpoint

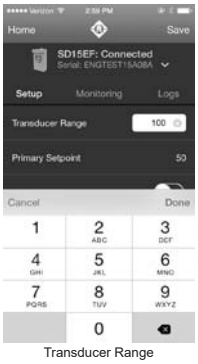
Also known as drawdown, this parameter sets the pressure to which the system pressure must be reduced before the controller will begin to run.
Default: 2 (bar) Minimum: 0.5 (bar)
Maximum: (Pressure Setpoint) – 0.5 (bar)



Pressure Control

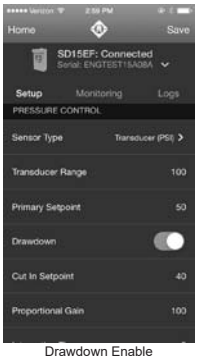


Sensor Selection

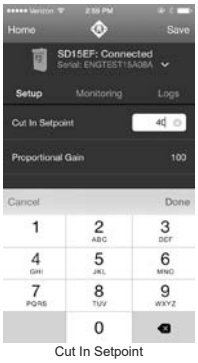


Transducer Range

Primary Setpoint



Drawdown Enable



Cut In Setpoint

Duplex Alternator: Configuration
SubDrive Connect models support the Duplex Alternator functionality built-in. This function requires an appropriate communication cable to be installed between two SubDrive Connect units.
Default: Standalone (controllers will operate independently)

Before the Duplex Alternator function will operate, each drive must be configured individually using the FE Connect app. The initial lead drive must be configured as Pump 1 and the initial lag drive must be configured as Pump 2.

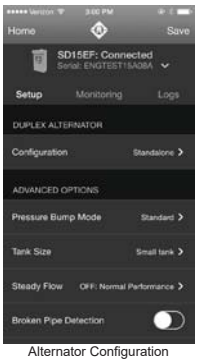
When using the built-in Duplex Alternator function with pressure transducers, the Primary Setpoint of Pump 1 must be set to the desired system pressure. The controller configured as Pump 1 will automatically control the pressure set point of the controller configured as Pump 2, setting it to 5 bar lower than the primary system set point. When using the built-in Duplex Alternator function with pressure switches, the pressure switch connected to the controller configured as Pump 1 must be set at least 3 PSI higher than the pressure switch connected to the controller configured as Pump 2.

NOTE: When using the drawdown function, the same cut-in pressure must be configured on both controllers.

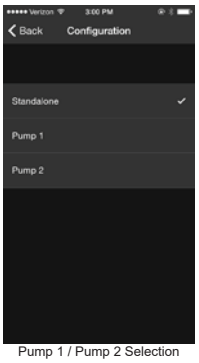
Duplex Alternator: Switching Interval
When operating two controllers using the Duplex Alternator function, this parameter sets the accumulated run time (hours) before the lead and lag systems will alternate roles.

Default: 1 Hour Minimum: 1 Hour Maximum: 24 Hours
The Switching Interval time setting on the controller configured as Pump 1 sets the interval time for the overall system.

Once the Duplex Alternator function is configured properly and operating, the status of the Duplex Alternator system is shown on the Monitor screen of the app. The roles of the lead and lag pump can be manually switched by pressing the Switch Pumps button.



Alternator Configuration



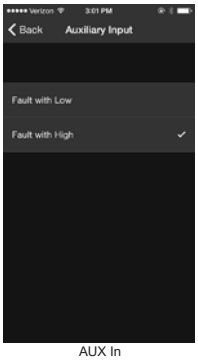
Pump 1 / Pump 2 Selection

Pump 1 Configured

Pump 2 Configured

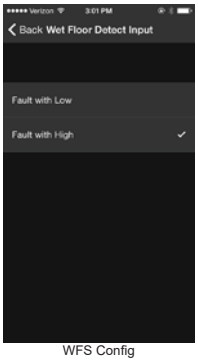
Alternator Monitor

Auxiliary Input:
This parameter controls how the controller will react when the AUX INPUT control terminal is used. This can be set as either Fault with High or Fault with Low.
Default: Fault with High
[Reference “AUX In” screenshot as a supporting figure]



AUX In

Moisture Sensor:
This parameter controls how the controller will react when the WET SENSOR control terminal is used. This can be set as either Fault with High or Fault with Low. The Fault with High condition supports the Franklin Electric Moisture Sensor device. The Fault with Low condition can be used with other unpowered dry contact switched input devices.
Default: Fault with High
[Reference “WFS Config” screenshot as a supporting figure]



WFS Config

Monitoring

This screen allows for real-time monitoring of the system including:

- System Status
- System Pressure (analog pressure transducer required)
- Built-In Duplex Alternator Status
- Motor Speed
- Input Voltage
- Output Voltage
- Output Current
- System Information (Drive Model, Hardware Version, Software Version)

Logs

This screen allows the Fault History and Configuration Change History logs to be viewed and emailed. This screen also displays the total Drive On Time and Motor Run Time along with the actual date and time when each log entry occurred.

Accessories

Accessory	Detail	Used with	Part Number
Analog Pressure Transducer	4-20mA analog pressure transducer used with "C" models (includes 3 m / 10 ft cable)	SD1100/1500/2200 - 6 bar SD1100/1500/2200 - 10 bar SD1100/1500/2200 - 16 bar	226905905 226905906 226905907
Analog Pressure Transducer Cable Kit	Outdoor rated cable to connect analog pressure transducer to "C" drive models	SD1100/1500/2200 - 3 m SD1100/1500/2200 - 7.5 m SD1100/1500/2200 - 15 m SD1100/1500/2200 - 30 m SD1100/1500/2200 - 45 m SD1100/1500/2200 - 60 m	226910901 226910902 226910903 226910904 226910905 226910906
Duplex Alternator Cable Kit	Communication cable kit required to use the built-in Duplex Alternator function in "C" drive models	SD1100/1500/2200 - 3 m SD1100/1500/2200 - 15 m SD1100/1500/2200 - 30 m	226895901 226895902 226895903
Enhanced Pressure Input Board Replacement Kit	Replacement board for "C" drives that have experienced a surge on the Enhanced Pressure Input Board.	SD1100/1500/2200	226540902
Enhanced Display Board Repalcement Kit	Replacement board for drives that have a damaged display	SD1100/1500/2200	226540912
Filter (Input)	Filter used on the input side of drive to help eliminate interference	SD1100/1500/2200	225198901
Filter (Output)	Filter used on the output side of the drive to help eliminate interference. If nuisance tripping of OL protection is observed, output filter 225930913 must be installed at the drive motor output	SD1100/1500/2200 (excluding SD300)	225300901
Filter (Surge Capacitors)	Capacitor used on the service panel to help eliminate power interference	SD1100/1500/2200	225199901
Lightning Arrestor	Single-phase (Input Power)	Single-phase (Input Power)	150814902
Moisture Sensor Kit	External sensor device that shuts down the drive when water is detected.	SD1100/1500/2200	226770901
IP 23 Fan Replacement Kit	Replacement fan	SD15 and MD "C" Models	226545904
IP 23 Fan Replacement Kit	Replacement fan	SD20, SD30, MDXT "C" Models	226545905
Pressure Sensor (High: 75-150 psi, NSF 61 rated)	Adjusts pressure in the water system from 5.2 - 10.3 bar (75 - 150 PSI) (2-leaded cable)	SD1100/1500/2200	225970901
Pressure Sensor (Standard Replacement: 25-80 psi, NSF 61 rated)	Adjusts pressure in the water system from 1.7 - 5.5 bar (25 - 80 PSI) (2-leaded cable)	SD1100/1500/2200	226941901
Sensor Cable Kit (outdoor)	30 meters (100 feet) of 0.3325 mm2 (22 AWG) cable (2-leaded)	SD1100/1500/2200	223995902
Output Filter	For use with longer motor leads	SD1100/1500/2200	225930913

Specifications – Single Phase Operation

		SubDrive1100	SubDrive1500/2200
Model No.	IP 23 (indoor/outdoor)	5870205153C	5870205353C / 5870205453C
Input from Power Source	Voltage	208/230 VAC from TN Electrical System	208/230 VAC from TN Electrical System
	Phase In	Single-Phase	Single-Phase
	Frequency	50/60 Hz	50/60 Hz
	Current (max)	11 A	16 A
	Power Factor	~ 0.95	~ 0.95
	Power (idle)*	4 W	5 W
	Power (max)	2.5 kW	4.2 kW
	Wire Gauge Size	See pg. 20. Consult Federal, State, and Local codes for branch circuit installations	See pg. 20. Consult Federal, State, and Local codes for branch circuit installations
Output to Motor	Voltage	Variable based on frequency	Variable based on frequency
	Phase Out	Single-Phase (3-Wire)	Single-Phase (3-Wire)
	Frequency Range	30 - 63 Hz	30 - 63 Hz
	Current (max)	10.4 A	13.2A
	Wire Gauge Size	See pg. 21 for wire sizing	See pg. 21 for wire sizing
Pressure Setting	Factory Preset	5 bar (73 psi)	5 bar (73 psi)
	Adjustment Range	Analog Transducer: 0.5 - 9.5 bar (7.3 - 137.8 psi)	Analog Transducer: 0.5 - 9.5 bar (7.3 - 137.8 psi)
Operating Conditions(A)	Temperature (at 230 VAC input)	-25 °C to 50 °C (-13 °F to 122 °F)	-25 °C to 50 °C (-13 °F to 122 °F)
	Relative Humidity	20-95%, non-condensing	20-95%, non-condensing
	Altitude 2000 m / IP 23 Enclosure	Pollution Degree 2	Pollution Degree 2
Controller Size(B) (approximate)	IP 23	250 x 427 x 130 mm : 8,2 kg	250 x 503 x 130 mm : 10,5 kg
	Pump (60 Hz)	0.37 kW (0.5 hp) pump with 214705-series motor 0.55 kW (0.75 hp) pump with 214707-series motor 0.75 kW (1.0 hp) pump with 214708-series motor	0.37kW (0.5 hp) pump with 214705-series motor 0.55kW (0.75 hp)pump with 214707-series motor 0.75kW (1.0 hp) pump with 214708-series motor 1.1kW (1.5 hp) pump with 224700-series motor 1.5kW (2.0 hp) pump with 224701-series motor
	FE Motor (60 Hz)	214705-series (0.37 kW), 0.5 hp) single-phase, 3-wire 214707-series (0.55 kW, 0.75 hp single-phase, 3-wire 214708-series (0.75 kW, 1.0 hp) single-phase, 3-wire	214705-series (0.37 kW, 0.5 hp) single-phase, 3-wire 214707-series (0.55 kW, 0.75 hp) single-phase, 3-wire 214708-series (0.75 kW, 1.0 hp) single-phase, 3-wire 214700-series (1.1 kW, 1.5 hp) single-phase, 3-wire 214701-series (1.5 kW, 2.0 hp) single-phase, 3-wire

Notes:

(A) Operating temperature is specified at full output power when installed as described in Location of Drive on pg. 15.
(B) Refer to pg. 27 for detailed Drive Mounting.
* Idle power is defined as input power used by the drive when the drive is not running the motor, the drive fan is off, and no communication is active. Idle power is increased by 1 W if Wi-Fi is on.

Specifications – SubDrive1100

SubDrive1100 - Three Phase Motors		
Model No.	IP 23 (indoor/outdoor)	5870205153C
Input from Power Source	Voltage	208/230 VAC from TN Electrical System
	Phase In	Single-Phase
	Frequency	50/60 Hz
	Current (max)	12 A
	Power Factor	~ 0.95
	Power (idle)*	4 W
	Power (max)	2.5 kW
	Wire Gauge Size	See pg. 20. Consult Federal, State, and Local codes for branch circuit installations
Output to Motor	Voltage	Variable based on frequency
	Phase Out	Three-Phase
	Frequency Range	60 Hz (1.1kW, 1.5 hp) Motor 30 - 77 Hz (0.55 kW, 0.75 hp) pump 30 - 72 Hz (0.75 kW, 1.0 hp) pump 30 - 60 Hz (1.1 kw, 1.5 hp) pump 30 - 63 Hz (Single-Phase Motors) 50 Hz (1.1kW, 1.5 hp) Motor 30 - 69 Hz (0.55 kW, 0.75 hp) pump 30 - 63 Hz (0.75 kW, 1.0 hp) pump 30 - 50 Hz (1.0 kW, 1.5 hp) pump No Single-Phase Motors
	Current (max)	5.9 A
	Wire Gauge Size	See pg. 21 for wire sizing
Pressure Setting	Factory Preset	5 bar (73 psi)
	Adjustment Range	0.5 - 9.5 bar (7.3 - 137.8 psi)
Operating Conditions(A)	Temperature (at 230 VAC input)	-25 °C to 50 °C (-13 °F to 122 °F)
	Relative Humidity	20-95%, non-condensing
	Altitude 2000 m / IP 23 Enclosure	Pollution Degree 2
Controller Size(B) (approximate)	IP 23	250 x 427 x 130 mm : 8,2 kg
For Use With	Pump (50 Hz)	0.37 kW (0.55 hp), 0.55 kW (0,75 hp), or 0,75 kW (1.0 hp) pump with 234753-series motor 0.55 kW (0.75 hp), 0.75 kW (1.0 hp), or 1.1 kW (1.5 hp) pump with 234754-series motor
	Pump (60 Hz)	0.37 kW (0.55 hp), 0.55 kW (0,75 hp), or 0,75 kW (1.0 hp) pump with 234713-series motor 0.55 kW (0.75 hp), 0.75 kW (1.0 hp), or 1.1 kW (1.5 hp) pump with 234714-series motor
	FE Motor (50 Hz)	234753-series (0,75kW,1.0 hp) three-phase 234754-series (1.1kW,1.5 hp) three-phase
	FE Motor (60 Hz)	234713-series (0,75kW,1.0 hp) three-phase 234714-series (1.1kW, 1.5 hp) three-phase

Notes:

(A) Operating temperature is specified at full output power when installed as described in Location of Drive on pg. 15.
(B) Refer to pg. 27 for detailed Drive Mounting.
* Idle power is defined as input power used by the drive when the drive is not running the motor, the drive fan is off, and no communication is active. Idle power is increased by 1 W, if Wi-Fi is on.

Specifications – SubDrive1500

SubDrive1500 - Three Phase Motors		
Model No.	IP 23 (indoor/outdoor)	5870205353C
Input from Power Source	Voltage	208/230 VAC from TN Electrical System
	Phase In	Single-Phase
	Frequency	50/60 Hz
	Current (max)	19 A
	Power Factor	~ 0.95
	Power (idle)*	5 W
	Power (max)	4.2 kW
	Wire Gauge Size	See pg. 20. Consult Federal, State, and Local codes for branch circuit installations
Output to Motor	Voltage	Variable based on frequency
	Phase Out	Three-Phase
	Frequency Range	60 Hz (1.5 kW, 2.0 hp) Motor 30 - 77 Hz (0.75 kW, 1.0 hp) pump 30 - 72 Hz (1.1 kW, 1.5 hp) pump 30 - 60 Hz (1.5 kw, 2.0 hp) pump 30 - 63 Hz (Single-Phase Motors) 50 Hz (1.5 kW, 2.0 hp) Motor 30 - 69 Hz (0.75 kW, 1.0 hp) pump 30 - 61 Hz (1.1 kW, 1.5 hp) pump 30 - 50 Hz (1.5 kw, 2.0 hp) pump No Single-Phase Motors
	Current (max)	8.1 A
	Wire Gauge Size	See Table pg. 21 for wire sizing
Pressure Setting	Factory Preset	5 (73 psi)
	Adjustment Range	0.5 - 9.5 bar (7.3 - 137.8 psi)
Operating Conditions(A)	Temperature (at 230 VAC input)	-25 °C to 50 °C(-13 °F to 122 °F)
	Relative Humidity	20-95%, non-condensing
	Altitude 2000 m / IP 23 Enclosure	Pollution Degree 2
Controller Size(B) (approximate)	IP 23	250 x 503 x 130 mm : 10,5 kg
For Use With	Pump (50 Hz)	0.37 kW (0.55 hp), 0.55 kW (0,75 hp), or 0,75 kW (1.0 hp) pump with 234753-series motor 0.55kW (0.75 hp), 0.75kW (1.0 hp), or 1.1kW (1.5 hp) pump with 234754-series motor 0.75kW (1.0 hp), 1.1kW (1.5 hp), or 1.5kW (2.0 hp) pump with 234755-series motor
	Pump (60 Hz)	0.37 kW (0.55 hp), 0.55 kW (0,75 hp), or 0,75 kW (1.0 hp) pump with 234713-series motor 0.55kW (0.75 hp), 0.75kW (1.0 hp), or 1.1kW (1.5 hp) pump with 234714-series motor 0.75kW (1.0 hp), 1.1kW (1.5 hp), or 1.5kW (2.0 hp) pump with 234755-series motor
	FE Motor (50 Hz)	234753-series (0,75kW,1.0 hp) three-phase 234754-series (1.1 kW, 1.5 hp) three-phase 234755-series (1.5 kW, 2.0 hp) three-phase
	FE Motor (60 Hz)	234713-series (0,75kW,1.0 hp) three-phase 234714-series (1.1 kW, 1.5 hp) three-phase 234715-series (1.5 kW, 2.0 hp) three-phase

Notes:

(A) Operating temperature is specified at full output power when installed as described in Location of Drive on pg. 15.
(B) Refer to pg. 27 for detailed Drive Mounting.
* Idle power is defined as input power used by the drive when the drive is not running the motor, the drive fan is off, and no communication is active. Idle power is increased by 1 W if Wi-Fi is on.

Specifications – SubDrive2200

SubDrive2200 - Three Phase Motors		
Model No.	IP 23 (indoor/outdoor)	5870205453C
Input from Power Source	Voltage	208/230 VAC from TN Electrical System
	Phase In	Single-Phase
	Frequency	50/60 Hz
	Current (max)	23 A
	Power Factor	~ 0.95
	Power (idle)*	5 W
	Power (max)	4.2 kW
	Wire Gauge Size	See Table pg. 20. Consult Federal, State, and Local codes for branch circuit installations
Output to Motor	Voltage	Variable based on frequency
	Phase Out	Three-Phase
	Frequency Range	60 Hz (2.2 kW, 3.0 hp) Motor 30 - 77 Hz (1.1 kW, 1.5 hp) pump 30 - 70 Hz (1.5 kW, 2.0 hp) pump 30 - 60 Hz (2.2 kw, 3.0 hp) pump 30 - 63 Hz (Single-Phase Motors) 50 Hz (2.2 kW, 3.0 hp) Motor 30 - 69 Hz (1.1 kW, 1.5 hp) pump 30 - 63 Hz (1.5 kW, 2.0 hp) pump 30 - 60 Hz (2.2 kw, 3.0 hp) pump No Single-Phase Motors
	Current (max)	10.9 A
	Wire Gauge Size	See Table pg. 21 for wire sizing
Pressure Setting	Factory Preset	5 bar (73 psi)
	Adjustment Range	0.5 - 9.5 bar (7.3 - 137.8 psi)
Operating Conditions(A)	Temperature (at 230 VAC input)	-25 °C to 50 °C (-13 °F to 122 °F)
	Relative Humidity	20-95%, non-condensing
	Altitude 2000 m / IP 23 Enclosure	Pollution Degree 2
Controller Size(B) (approximate)	IP 23	250 x 503 x 130 mm : 10,5 kg
For Use With	Pump (50 Hz)	0.37 kW (0.55 hp), 0.55 kW (0,75 hp), or 0,75 kW (1.0 hp) pump with 234753-series motor 0.55 kW (0.75hp), 0.75 kW (1.0 hp), or 1.1 kW (1.5 hp) pump with 234754-series motor 0.75 kW (1.1hp), 1.1 kW (1.5 hp), or 1.5 kW (2.0 hp) pump with 234755-series motor 1.1 kW (1.5hp), 1.5 kW (2.0 hp), or 2.2 kW (3.0 hp) pump with 234756-series motor
	Pump (60 Hz)	0.37 kW (0.55 hp), 0.55 kW (0,75 hp), or 0,75 kW (1.0 hp) pump with 234713-series motor 0.55 kW (0.75 hp), 0.75 kW (1.0 hp), or 1.1 kW (1.5 hp) pump with 234714-series motor 0.75 kW (1.1 hp), 1.1 kW (1.5 hp), or 1.5 kW (2.0 hp) pump with 234715-series motor 1.1 kW (1.5 hp), 1.5 kW (2.0 hp), or 2.2 kW (3.0 hp) pump with 234716-series motor
	FE Motor (50 Hz)	234753-series (0,75kW,1.0 hp) three-phase 234754-series (1.1 kW, 1.5 hp) three-phase 234755-series (1.5 kW, 2.0 hp) three-phase 234756-series (2.2 kW, 3.0 hp) three-phase
	FE Motor (60 Hz)	234713-series (0,75kW,1.0 hp) three-phase 234714-series (1.1 kW, 1.5 hp) three-phase 234715-series (1.5 kW, 2.0 hp) three-phase 234716-series (2.2 kW, 3.0 hp) three-phase

Notes:

(A) Operating temperature is specified at full output power when installed as described in Location of Drive on pg. 15.
(B) Refer to pg. 27 for detailed Drive Mounting.
* Idle power is defined as input power used by the drive when the drive is not running the motor, the drive fan is off, and no communication is active. Idle power is increased by 1 W if Wi-Fi is on.

DIAGNOSTIC FAULT CODES

FAULT CODE	FAULT	POSSIBLE CAUSE	CORRECTIVE ACTION
F14	BROKEN PIPE	- Broken pipe or large leak is detected in the system - Drive runs at full power for 10 minutes without reaching pressure setpoint - Large water draw, such as a sprinkler system, does not allow system to reach pressure setpoint	- Check system for large leak or broken pipe - If the system contains a sprinkler system or is being used to fill a pool or cistern, disable the Broken Pipe Detection
F15 (SD15/20/30 ONLY)	PHASE IMBALANCE	- Motor phase currents differ by 20% or more. - Motor is worn internally - Motor cable resistance is not equal - Incorrect motor type setting (single- or three- phase)	- Check resistance of motor cable and motor windings - Verify motor type matched drive settings (single- or three-phase)
F16	GROUND FAULT	- Motor output cable is damaged or exposed to water - Phase to ground short	- Check motor cable insulation resistance with megger (while not connected to drive). Replace motor cable if needed.
F17	INVERTER TEMPERATURE SENSOR FAULT	- Internal temperature sensor is malfunctioning	- Contact your Franklin Electric Service Personnel - If problem persists, unit may require replacement. Contact your supplier.
F18 (SD20/30/MDXT ONLY)	PFC TEMPERATURE SENSOR FAULT	- Internal temperature sensor is malfunctioning	- Contact your Franklin Electric Service Personnel - If problem persists, unit may require replacement. Contact your supplier.
F19	COMMUNICATION FAULT	- Cable connection between Display/Wi-Fi Board and Main Control Board is loose or disconnected - Internal circuit failure	- Check cable connection between Display/Wi-Fi Board and Main Control Board. - If problem persists, unit may require replacement. Contact your supplier.
F22	DISPLAY/WI-FI BOARD EXPECTED FAULT	- Connection between Display/Wi-Fi Board and Main Control Board was not detected at drive start-up	- Check cable connection between Display/Wi-Fi Board and Main Control Board. - If problem persists, unit may require replacement. Contact your supplier.
F23	MAIN BOARD STARTUP FAULT	- A fault was found internal to drive	- Contact your Franklin Electric Service Personnel - Unit may require replacement. Contact your supplier.
F24	INVALID DIP SWITCH SETTING	- No DIP Switch set or more than one (1) DIP Switch set for Motor size - No DIP Switch set or more than one (1) DIP Switch set for Pump size - Invalid combination of DIP switches for drive type (SD or MD mode), Motor hp, and Pump hp.	- Check DIP switch settings
F25	MOISTURE SENSOR FAULT	- Moisture Sensor has detected moisture or water - External device wired to the WET SENSOR terminal has satisfied the configured fault condition - Input is incorrectly configured	- Check Moisture Sensor location for moisture or presence of water. Clean and dry area. Controller will restart when moisture or water is no longer detected. - Ensure Moisture Sensor input is configured correctly
F26	AUX INPUT FAULT	- External device wired to the AUX IN terminal has satisfied the configured fault condition - Input is incorrectly configured	- Ensure the Auxiliary Input is configured correctly
F27	PRESSURE TRANSDUCER ERROR	- Analog pressure transducer has failed - Analog pressure transducer is incorrectly wired - Analog pressure transducer signal is outside of the expected range - Analog pressure transducer is disconnected - Analog pressure transducer is being used but DIP SW1 Position 5 is in the UP position - Pressure switch is being used but SW1 Position 5 is in the DOWN position	- Check pressure transducer wiring connections - Ensure DIP SW1 Position 5 is in the correct position for the sensor type being used (DOWN for pressure transducer, UP for pressure switch) - Replace pressure transducer
F28	REAL TIME CLOCK FAULT	- Internal real time clock is not programmed - Real time clock battery on display board is loose - Real time clock battery is dead	- Ensure battery is properly inserted. If corrected, reconnect to controller using mobile app to reset the internal clock time - Replace battery. If replaced, reconnect to the controller using the mobile app to reset the internal clock time
F41	DUPLEX ALT[SENSOR MISMATCH	- Controllers using the built-in Duplex Alternator function are configured with pressure sensor types that do not match	- Controllers using the built-in Duplex Alternator function must have matching pressure sensor types. Both controllers must be configured to use a traditional SubDrive pressure sensor or analog pressure transducer. - If both controllers are configured with an analog pressure transducer, the transducers must both be PSI type or bar type.
F42	DUPLEX ALTERNATOR FIRMWARE MISMATCH	- Controllers using the built-in Duplex Alternator function have firmware versions that are not matched	- Firmware version of one or both controllers must be updated to a matching firmware version using the FE Connect mobile app.
F43	DUPLEX ALTERNATOR COMM FAULT	- Improper Duplex Alternator cable connection - Duplex Alternator cable is damaged	- Check Duplex Alternator cable connections - Replace Duplex Alternator cable
F44	DUPLEX ALTERNATOR UNEXPECTED COMM	- Duplex Alternator cable is installed but Duplex Alternator function is only is only configured on one controller - Controllers are incorrectly configured	- Complete Duplex Alternator configuration on both controllers - Ensure both controllers are configured properly (one drive must be configured as Pump 1, the other drive must be configured as Pump 2, and the Switching Interval must match)
F45	DUPLEX ALTERNATOR DEMAND FAULT	- Both controllers are running and unable to satisy the Primary Setpoint pressure	- Inspect each system for proper pump operation

Power down, disconnect leads to the motor and power up the SubDrive:

- If the SubDrive does not give an “open phase” fault (F5), then there is a problem with the SubDrive.
- Connect the SubDrive to a dry motor. If the motor goes through DC test and gives “underload” fault (F1), the SubDrive is working properly.

DIAGNOSTIC FAULT CODES

FAULT CODE	FAULT	POSSIBLE CAUSE	CORRECTIVE ACTION
F1	MOTOR UNDERLOAD	- Overpumped well - Broken shaft or coupling - Blocked screen, worn pump - Air/gas locked pump - SubDrive not set properly for pump end - Underload Sensitivity setting incorrect	- Frequency near maximum with load less than configured underload sensitivity (Potentiometer or Wi-Fi) - System is drawing down to pump inlet (out of water) - High static, light loading pump - reset Potentiometer for less sensitivity if not out of water - Check pump rotation (SubDrive only) reconnect if necessary for proper rotation - Air/gas locked pump - if possible, set deeper in well to reduce - Verify DIP switches are set properly - Check Underload Sensitivity Setting (Potentiometer or Wi-Fi setting, whichever is applicable)
F2	UNDERVOLTAGE	- Low line voltage - Misconnected input leads - Loose connection at breaker or panel	- Line voltage low, less than approximately 150 VAC (normal operating range = 190 to 260 VAC) - Check incoming power connections and correct or tighten if necessary - Correct incoming voltage - check circuit breaker or fuses, contact power company
F3	OVERCURRENT / LOCKED PUMP	- Motor and/or pump misalignment - Dragging motor and/or pump - Motor and/or pump locked - Abrasives in pump - Excess motor cable length	- Amperage above max. Amps at 30 Hz - Remove and repair or replace as required - Reduce motor cable length. Adhere to Maximum Motor Cable Length table.
F5	OPEN PHASE	- Loose connection - Defective motor or drop cable - Wrong motor	- Open reading on DC test at start. - Check drop cable and motor resistance, tighten output connections, repair or replace as necessary, use “dry” motor to check drive functions. If drive will not run and exhibits underload fault replace drive
F6	SHORT CIRCUIT	- When fault is indicated immediately after power-up, short circuit due to loose connection, defective cable, splice or motor	- Amperage exceeded 25 amps on DC test at start or SF amps during running - Incorrect output wiring, phase to phase short, phase to ground short in wiring or motor - If fault is present after resetting and removing motor leads, replace drive
F7	OVERHEATED DRIVE	- High ambient temperature - Direct sunlight - Obstruction of airflow	- Drive heat sink has exceeded max rated temperature, needs to drop below 90 °C (194 °F) to restart - Fan blocked or inoperable, ambient above 50 °C (122 °F), direct sunlight, air flow blocked - Replace fan or relocate drive as necessary - Remove debris from fan intake/exhaust - Remove and clean optional air screen kit (if installed)
F9	INTERNAL PCB FAULT	- A fault was found internal to drive	- Contact your Franklin Electric Service Personnel - Unit may require replacement. Contact your supplier.
F12	OVERVOLTAGE	- High line voltage - Internal voltage too high	- Line voltage high - Check incoming power connections and correct or tighten if necessary - If line voltage is stable and measured below 260 VAC and problem persists, contact your Franklin Electric Service Personnel

Power down, disconnect leads to the motor and power up the SubDrive:

- If the SubDrive does not give an “open phase” fault (F5), then there is a problem with the SubDrive.
- Connect the SubDrive to a dry motor. If the motor goes through DC test and gives “underload” fault (F1), the SubDrive is working properly.

SUBDRIVE TROUBLESHOOTING

CONDITION	INDICATOR LIGHTS	POSSIBLE CAUSE	CORRECTIVE ACTION
NO WATER	NONE	- No supply voltage present - Display board cable disconnected or loose	- Verify cable connection between main control board and display board - If correct voltage is present, replace drive
	GREEN "---" ON DISPLAY	- Pressure sensor circuit	- Verify water pressure is below system set point - If Pressure Input Board break-away tab is removed, ensure auxiliary device is connected and closed circuit - If Pressure Input Board break-away tab is removed and no auxiliary device is being used, manually short-circuit "AUX IN" connections - Jumper wires together at pressure sensor; if pump starts, replace sensor - If pump doesn't start, check sensor connection at Pressure Input Board; if loose, repair - If pump doesn't start, jumper sensor connection at Pressure Input Board. If pump starts, replace wire - If pump doesn't start with sensor Pressure Input Board connection jumpered, replace Pressure Input Board - If pump doesn't start with new Pressure Input Board, replace drive
	RED FAULT CODE ON DISPLAY	- Fault detected	- Proceed to fault code description and remedy
	GREEN MOTOR FREQUENCY ON DISPLAY	- Drive and motor are operating - Loose switch or cable connection - Incorrect motor or pump settings - Motor may be running backwards - Gulping water at pump inlet	- Verify Maximum Frequency setting. If this setting was reduced below maximum value, increase - Verify motor/pump ratings and match to motor/pump settings on drive (DIP switch or Wi-Fi) - Verify motor connections - Frequency max, amps low, check for closed valve, or stuck check valve - Frequency max, amps high, check for hole in pipe - Frequency max, amps erratic, check pump operation, dragging impellers - This is not a drive problem - Check all connections - Disconnect power and allow well to recover for short time, then retry
PRESSURE FLUCTUATIONS (POOR REGULATION)	GREEN MOTOR FREQUENCY ON DISPLAY	- Pressure sensor placement and setting - Pressure gauge placement - Pressure tank size and pre-charge - Leak in system - Air entrainment into pump intake (lack of submergence)	- Correct pressure and placement as necessary - Tank may be too small for system flow - This is not a drive problem - Disconnect power and check pressure gauge for pressure drop - Set deeper in the well or tank; install a flow sleeve with airtight seal around drop pipe and cable - If fluctuation is only on branches before sensor, enable Steady Flow - Change tank size configuration
RUN ON WON'T SHUT DOWN	GREEN MOTOR FREQUENCY ON DISPLAY	- Pressure sensor placement and setting - Tank pre-charge pressure - Impeller damage - Leaky system - Sized improperly (pump can't build enough head)	- Check frequency at low flows, pressure setting may be too close to pump max head - Verify precharge at 70% if tank size is larger than minimum, increase precharge (up to 85%) - Verify that the system will build and hold pressure - Enable bump and/or aggressive bump - Increase minimum frequency
RUNS BUT TRIPS	FLASHING RED	- Check fault code and see corrective action	- Proceed to fault code description and remedy on reverse side

SUBDRIVE TROUBLESHOOTING

CONDITION	INDICATOR LIGHTS	POSSIBLE CAUSE	CORRECTIVE ACTION
LOW PRESSURE	GREEN MOTOR FREQUENCY ON DISPLAY	- Pressure sensor setting, pump rotation, pump sizing - High temperature	- Adjust pressure sensor, check pump rotation - Check frequency at max flow, check max pressure - High ambient and/or drive temperature will cause drive to foldback power and run with reduced performance
HIGH PRESSURE	GREEN MOTOR FREQUENCY ON DISPLAY	- Pressure sensor setting - Shorted sensor wire	- Adjust pressure sensor - Remove sensor wire at Pressure Input Board, if drive stops running, wire may be shorted - Remove sensor wire at Pressure Input Board, if drive continues to run, replace Pressure Input Board - Remove sensor wire at new Pressure Input Board, if drive continues to run, replace drive - Verify condition of sensor wire and repair or replace if necessary
AUDIBLE NOISE	GREEN MOTOR FREQUENCY ON DISPLAY	- Fan, hydraulic, plumbing	- For excessive fan noise, replace fan - If fan noise is normal, drive will need to be relocated to a more remote area - If hydraulic, try raising or lowering depth of pump - Pressure tank location should be at entrance of water line into house
NO DISPLAY	NONE	- Display board cable disconnected or loose	- Verify cable connection between main control board and display board
CANNOT CONNECT TO DRIVE WI-FI	FE CONNECT LIGHT ON SOLID	- Attempting to connect to incorrect drive - Out of Wi-Fi range of drive	- Ensure the Wi-Fi SSID (hotspot name) you are connecting to matches the drive you wish to connect to - Wi-Fi range is 100 feet line-of-site, must be closer to drive if walls or floors are between you and the drive - Wi-Fi module not responding, cycle power to drive - Cycle Wi-Fi radio on mobile device, refresh Wi-Fi connection list
	FE CONNECT LIGHT OFF	- Wi-Fi timeout expired	- If more than fifteen (15) minutes since last power cycle, cycle power to drive - If more than one (1) hour since last disconnection from Wi-Fi, cycle power to drive
RFI-EMI INTERFERENCE	GREEN MOTOR FREQUENCY ON DISPLAY	- Poor grounding - Wire routing	- Adhere to grounding and wire routing recommendations - An additional external filter may be needed. See Accessories section for ordering information

Franklin Electric

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STANDARD LIMITED WARRANTY

1. Franklin Electric Europa GmbH („Franklin Electric“) warrants that its product will be free from defects in workmanship and material on delivery, and consistently useable with samples previously published or agreed with the Purchaser; this warranty is given for the period of one year from the date of installation but in any event no longer than for two years from the date of manufacture.

2. In fulfillment of its warranty obligations Franklin Electric shall be entitled at its option to remedy defects or to deliver substitute products, both free of charge for the Purchaser. No allegedly defective product shall be returned to Franklin Electric, however, without Franklin Electric’s prior written authorization and shipping instructions. Should the remedial works of a defect or delivery of a substitute product fail, the purchaser may at its opinion cancel the contract or demand and appropriate reduction of the purchase price.

3. Franklin Electric shall not assume any warranty for damages caused by inappropriate use, abuse, neglect, accident or improper installation or maintenance or for products which have been altered or repaired by anyone other than Franklin Electric or its authorized representatives.

4. In relation to products which have been manufactured according to the specifications of the Purchaser, Franklin Electric does not assume any warranty for the correctness and appropriateness of such specifications or that the product when manufactured according to the specifications may indeed be usable for the intended purpose.

5. Franklin Electric shall be liable for damages

   (a.) For damage caused by Franklin Electric or its servants in an intentional or grossly negligent manner;

   (b.) in the case of breach of material contractual obligations through slight negligence but limited to foreseeable damages typical to this type of contract;

   (c.) under the provision of the Product Liability Act and any other mandatory statutory liability provisions;

   (d.) for the damage caused by a defect due to the absence of a specifically warranted characteristic and or such consequential damages caused by a defect against which the specifically characteristic was meant to protect the Purchaser.

   If none of these cases applies Franklin Electric shall not be liable for any damages. The provision of the above sentences apply to all claims for damages irrespective of their legal basis, in particular to liability in tort, for positive breach of the contract (“positive Vertragsverletzung”) and for breach of duties during contractual negotiations (“Verschulden bei Vertragsverhandlungen”).

6. These warranty provisions are subject to German law. The place of jurisdiction is Wittlich.

FRANKLIN ELECTRIC EUROPA GMBH

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Rev. 0
04-17

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