KELCO F29 MK3

DIGITAL PUMP CONTROLLER

INSTALLATION &
PROGRAMMING MANUAL

KELCO Engineering Pty Ltd
Sydney Australia

www.kelco.com.au

VERY IMPORTANT SAFETY NOTICE
PLEASE READ THIS BEFORE INSTALLING THIS CONTROLLER

The F29 MK3 is an industrial control device. It is specifically designed for use in industrial, agricultural and mining applications. It must never be used for any application other than for the aforesaid purposes. The installation, commissioning of this pump controller requires extensive knowledge of pump engineering and electrical engineering. Installation must always be carried out by a qualified pump engineer and all electrical work associated with this controller must be carried out by a licensed Electrician. This industrial control device must not be operated by persons (including children) with reduced physical or mental capabilities, or lack of experience and knowledge, unless they have been given supervision or instruction concerning the use of this pump controller by a person responsible for their safety.

IMPORTANT: READ THIS FIRST

DO NOT EXPOSE THE F29 MK3 TO VIBRATION. INSTALL ONLY IN PIPEWORK THAT DOES NOT VIBRATE. Vibration will damage the electronics within the F29 and will void your product warranty.

This F29 programmable flow switch has been fully tested and calibrated. It is set to operate in a basic way with most of its special functions and features switched off. On start up the F29 will run the pump using its start up timer for up to 5 seconds. If it finds flow in the first 5 seconds it will continue to run the pump. If flow is lost, the pump will continue to run for 5 seconds held on by the F29's built in run-on timer. If flow fails to return, the pump will be shut down after the run-on period. Pressing and releasing the **(R)** reset button on the F29 or resetting the power will repeat this basic process.

THE BUTTONS

The F29 is controlled and configured using 4 onboard buttons.

(R) Reset button: Stops the pump and restarts the F29 when released.
(^) Up arrow button: For increasing program settings.
(v) Down arrow button: For decreasing program settings.
(P) Programming button: For stepping through the menu and entering settings into memory.

THE LIGHTS

The F29 includes 4 multicolour lights to indicate activity.

Flow: This light is **GREEN** when the F29 detects flow and **RED** when no flow is detected.
Pump: This light is **GREEN** when a pump is running and **RED** when the pump is stopped.
Timer: This light may be **GREEN** or **RED** when a timer or special function is running.
Remote: This light is **BLUE** when remote input No. 1 is closed and off when the remote is open. The light is **RED** when remote input No. 2 is closed and off when the remote is open. This light is **PURPLE** when both remote inputs 1 & 2 are closed.

LCD SCREEN BACKLIGHT

The LCD backlight can be turned on or off.
To turn the light off press and hold down the **(v)** button. Press and release the **(R)** button. Release the **(v)** button. Repeat to turn the light on. The light remembers the state it was last left in, if power is turned off. The light can be left permanently on or off as required.

TEMPERATURE

The F29 monitors its internal temperature when running. Pressing the **(v)** button while the flow switch is powered up displays the current internal temperature of the F29.

PRESS (and release) THE (P) BUTTON

When the F29 is powered up, pressing the **(P)** button, holding it down for 1 second and releasing it takes you to the top of the menu. Pressing and releasing the **(P)** button loads whatever the screen is displaying into the F29's memory. The memory is non-volatile and settings are retained when power is off. You can exit the menu at any time by pressing and releasing the **(R)** button. Any settings you have made up to that point will be retained. There is no need to step all the way through the menu when making a change to a setting.

INSTALLING THE F29

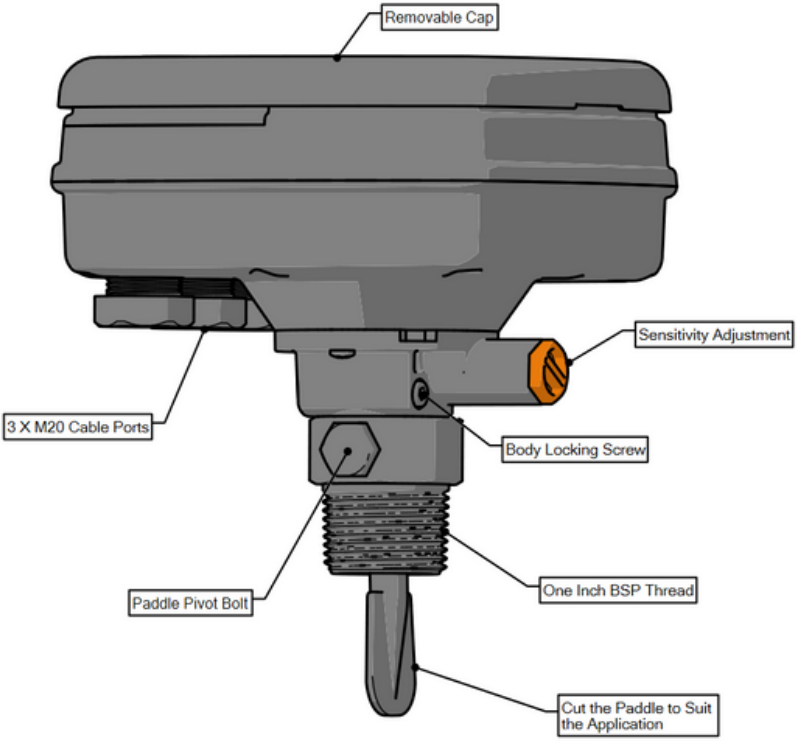
1) Do not install the F29 in an exposed outdoor location. The F29 is weatherproof, however, to ensure a long reliable life we recommend it be protected from direct exposure to the sun and rain. A skull cap is provided with the F29 and we recommend it be used to protect the F29 when direct observation of the LCD screen is not required.

2) Do not expose the F29-S to freezing. If the F29 is to be used in areas where freezing conditions will be encountered, use the stainless steel F29-SS and always lag the pipework for several metres either side of the flow switch to prevent the adjacent pipework from freezing.

3) Do not use the standard thermoplastic F29-S flow switch in hot water applications. The standard F29-S is not designed to be used in water hotter than 60°C. The stainless steel model can be used in water up to 90°C.

4) Do not expose the thermoplastic F29-S to static or dynamic pressures greater than 18 Bars, 261 psi. Do not expose the stainless steel F29-SS to static or dynamic pressures greater than 200 Bars, 2900 psi.

5) Do not install the F29 in a section of pipe that is subject to vibration. Vibration will cause premature failure of the electronic components within the F29.

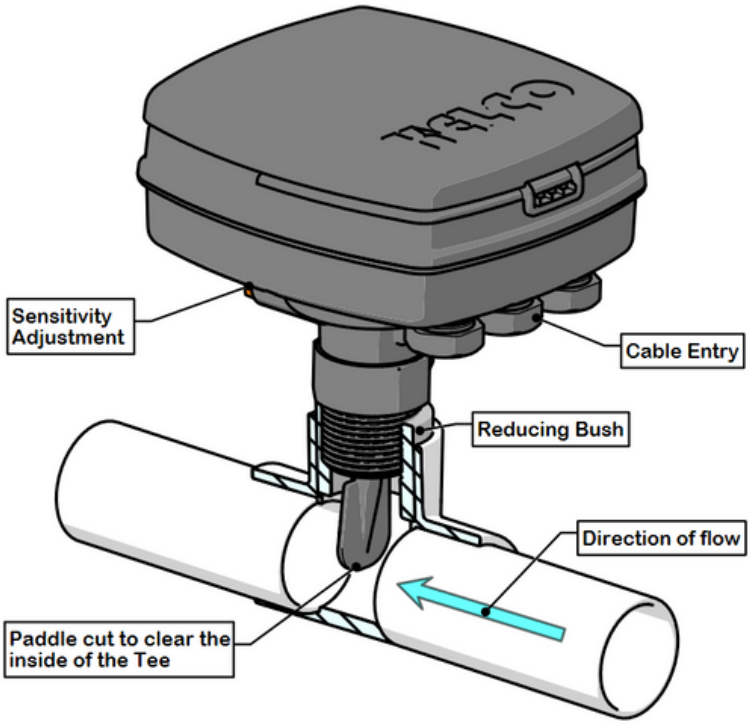


LOCATION

Where possible install the F29 in a location that is sheltered from direct exposure to the weather. The F29 is weatherproof and is supplied with a protective cover. However, to ensure a long reliable life we recommend it be protected from direct exposure to the sun and rain. Intense sun light will eventually cause discolouration and degradation of the flow switch's housing. It is therefore advisable to protect the F29 from the weather if possible.

The F29 should be installed in a straight section of pipe preferably with 5 diameters of straight pipe either side of the paddle. The F29 can be installed in a suitable pipe socket, tapping saddle or pipe tee.

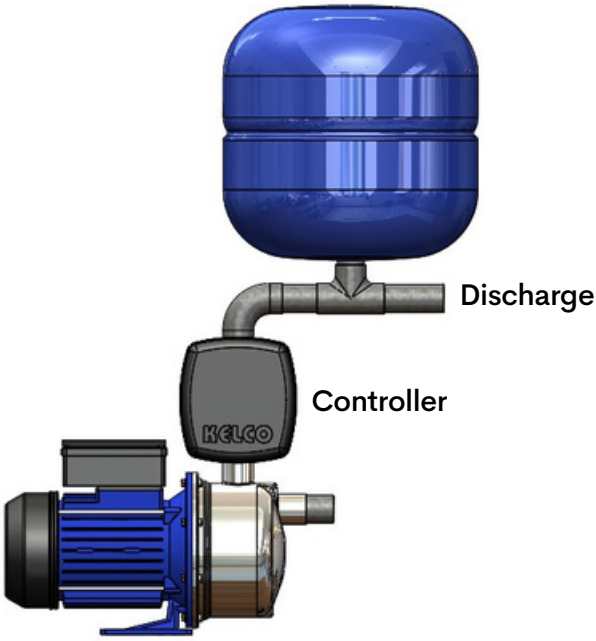
The F29 can be installed in either the suction or discharge pipework of the pump. It is more common to install it in the discharge pipe, either before or after the system's air cell. If the system includes an air cell a decision must be made as to which side of the air cell to locate the flow switch. The way the overall system functions will depend on this decision.



BEFORE THE AIR CELL

If the F29 is installed before the air cell, it will only start the pump on pressure drop via an external pressure switch since the initial draw off will be supplied from the air cell and will not push the paddle of the F29 into its on position.

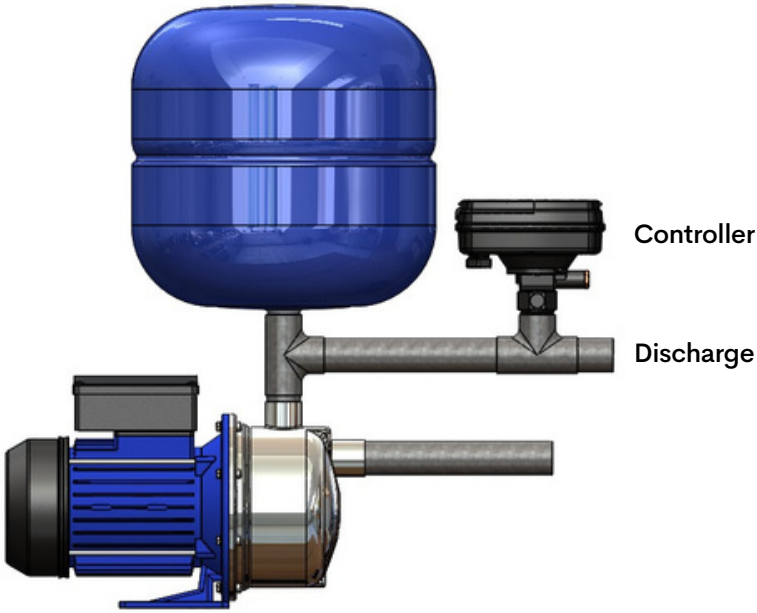
The only change in state the flow switch will see will be the closing of the external pressure switch's contacts on a falling pressure. Choose this arrangement if you want to keep pump starts to a minimum and you are prepared to accept the delay in starting associated with the slow pressure fall from the air cell.



Controller installed before the air cell

AFTER THE AIR CELL

If you install the F29 in the pipework after the air cell the flow switch will start the pump each time flow from the air cell pushes its paddle forward or each time pressure falls to whatever pressure you have set the external pressure switch to start at. Choose this arrangement if you want the system to deliver a steady pressure and to start each time flow is sensed.



Controller installed after the air cell

INSTALLATION

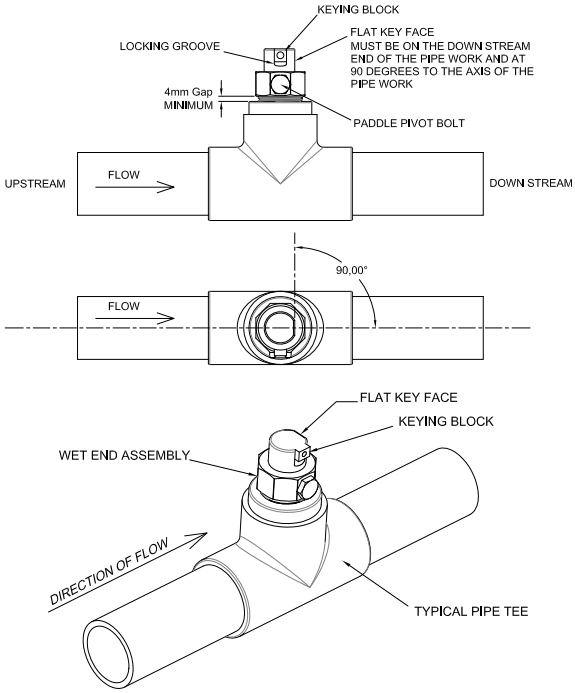
The F29 is supplied as two separate assemblies, the paddle assembly and the electrical housing. The paddle assembly should be installed in the pipework first.

TRIMMING THE PADDLE

The paddle of the F29 can be cut down to suit the specific pipe size and intended application. Cut the paddle using a hacksaw or tin snips so it clears the sides of the pipe socket and protrudes approximately half to two thirds of the way across the pipe when the controller is screwed into the pipework. If a low flow rate is expected through the system the paddle should be cut longer, perhaps until it only clears the bottom of the pipe by 3 to 5mm. If you are unsure as to what length the paddle should be, a paddle trimming calculator is available at:

https://https://www.kelco.com.au/paddle-trimming-calculator/

If you know what the expected flow rate is the calculator allows you to enter your pipe diameter and paddle dimensions. It will then determine if the selected paddle dimensions are adequate for the application. Spare paddles to suit the F29 MK3 are available from Kelco or from your distributor.



INSTALLING THE WET END

VERY IMPORTANT SAFETY NOTE

A pressure relief valve should be fitted to any system that can exceed the pressure rating of any component on that system. Alternately, always confirm that the pressure safety limits of individual items are compatible and not compromised without the fitting of appropriate safety devices, i.e. a Pressure Relief Valve (PRV).

FITTING THE PADDLE ASSEMBLY

To fit the paddle assembly into the pipework, apply Teflon tape or thread sealing compound to the thread and use a suitable spanner and the spanner flats provided on the paddle assembly (directly above the process connection thread). Under no circumstances should the electrical housing be twisted or used to screw the paddle assembly into the pipework or to align the F29 with the axis of the pipework. To do so will irreparably damage the F29 and void its warranty.

When correctly installed there should be a minimum 4mm gap between the top of the pipe socket and the top of the thread on the F29. The F29 can be installed in either vertical or horizontal pipe. The F29 has a 1″ BSP process

connection. A matching female threaded socket, pipe saddle or pipe tee must be provided to fit the F29 into the pipework.

ATTACHING THE ELECTRICAL HOUSING

There is a flat keying face on the cylindrical body of the paddle assembly that keys the electrical housing onto the paddle assembly and aligns it correctly. It is critical that the keying flat is on the downstream side and at 90 degrees to the axis of the pipework (see sketch). To secure the electrical housing onto the paddle assembly an Allen head cap screw is supplied. The cap screw should be screwed fully through the hole provided on the underside of the electrical housing and should be securely tightened using a 3mm A/F Allen key (supplied).

DETACHING THE ELECTRICAL HOUSING

To allow easy access to the flow switch's paddle, the electrical housing of the F29 can be detached from the paddle assembly. Removing the electrical housing allows access to the paddle without the need to disconnect the electrical connections to the F29. To remove the electrical assembly, switch off the system's power and undo and completely remove the locking screw (see diagram). Once the locking screw is removed, lift the electrical housing straight off (do not twist it when doing this). Once the electrical housing has been removed, the paddle assembly can be unscrewed from the pipework using the spanner flats on the body of the assembly. Simply reverse this procedure to refit the electrical housing to the F29.

SENSITIVITY ADJUSTMENT

Under the end of the electrical housing on the F29 is a red hexagonal dust cap. If you remove this dust cap you gain access to an adjustment screw that allows the paddle preload to be reduced. As supplied the sensitivity adjustment screw is wound fully in. In this position the paddle is at its least sensitive. In this position it takes a substantial force from the moving water to move the paddle. If you take a straight bladed screwdriver and wind the sensitivity adjustment screw anti-clockwise (outward) the force against the paddle that resists flow will be reduced.

The paddle will become increasingly more sensitive and will respond to progressively lower flows the further out you wind the adjusting screw. The total adjustment range is 10 turns of the screw. If you wind the adjustment screw out beyond 10 turns there will not be enough residual force to return the paddle to the off position when flow stops.
The range of sensitivity adjustment will also be affected by the orientation of the F29. In horizontal pipework with the F29 mounted vertically the useable range of adjustment is approximately 8 turns. In vertical pipe with flow upwards, the full 10 turn range can be utilised.

ELECTRICAL INSTALLATION



WARNING

All electrical work associated with the F29 must be carried out by qualified electrical personnel and all electrical work must conform to AS/NZ standards and to local wiring rules.

INTRODUCTION

When used with its HD terminal link in place, the F29 can directly control single-phase pump motors to 2.4kW via its relay 1. No interposing contactor is required for such applications. The F29 can also be used to control 3 phase pump motors of any size via an appropriate interposing contactor.

WARNING: The contactor control circuit must never exceed 240VAC. Never series connect the F29 relay contacts and contactor coil directly across 2 phases

The F29 requires a stable 220V to 240V AC supply when operated from the mains. It can also be operated from an 18 to 24V AC or DC supply by

utilising the low voltage active terminal LV and neutral terminal N (see the included wiring diagrams). When operated from a low voltage DC supply the terminals LV and neutral N are not polarity sensitive. Pay attention to cable sizes and ensure cables are adequate for the specific pump motor load. This is particularly important where long cable runs are to be used in the installation. If the voltage drop associated with the starting of the pump motor is excessive the F29 may repeatedly reset and not operate properly.

THE HD (Heavy Duty) TERMINAL

The F29 contains a solid-state switch (HD Heavy Duty drive) that can be used to protect the contacts of Relay 1 by eliminating the destructive arcing caused by the starting and stopping of pump motors. The solid-state switch is accessible from the HD terminal on the terminal block. We recommend the HD drive be used whenever the controller is used to directly control a single-phase pump motor. The HD drive should not be used when the F29 is connected to a contactor, external timer, low wattage relay or to any other external device where voltage free contacts are required. It is strictly intended for the direct control of highly inductive AC motor loads. The HD terminal and the controller's built in relays must never be directly connected to a DC motor under any circumstances.

When the HD terminal is linked to the normally open terminal of Relay 1, the HD drive in effect parallels a 42 Amp solid state switch across the relay's normally open contacts. This increases the momentary current carrying capacity of the relay's contacts to well over 60 Amps. The solid- state HD drive is only activated for a brief period when the pump starts and stops. It effectively handles the high inrush current associated with the pump starting, and it provides a current path for the destructive back EMF associated with the pump motor stopping.

To use the HD drive, place a heavy link wire between the HD terminal and the Normally Open terminal of Relay 1.



WARNING

The HD terminal must be left unused or only ever linked to Relay 1 Normally Open. It must never be used for any other purpose and it must never be connected to any external device. Under no circumstances connect the HD terminal to the terminals of Relay 2. The HD terminal must be regarded as live at all times and at full mains potential.

IMPORTANT

A means for disconnection of the F29 must be incorporated in the fixed wiring in accordance with the wiring rules.

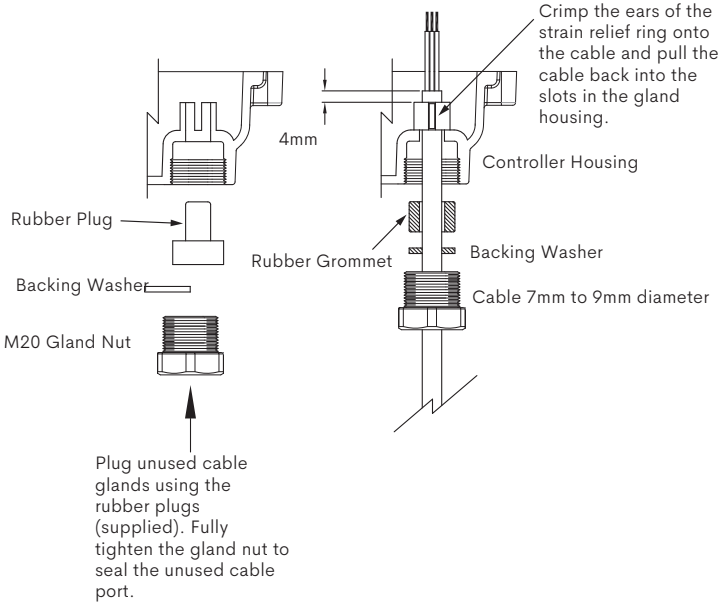
BROWNOUT OR BLACKOUT

If a blackout or brownout occurs the F29 will not retain any memory of where in its run or stop cycle it may have been, it will simply shut down the pump. When power resumes, the F29 will reboot, restart the pump and run any timer settings from the beginning. A manual reboot can be done at any time by pressing and releasing the F29's reset button.

CABLES

The F29 has 3 X M20 cable glands. As supplied, the cable glands are blanked off with rubber plugs. To use the glands first remove one of the rubber plugs and assemble the (supplied) cable gland bush and backing washer into the cable port. The cable glands can accept cable from 7 to 9mm diameter. See sketch for assembling the cable gland components.

The F29 is supplied with a set of steel crimp rings. The crimp rings are to provide strain relief for the controller's cables. To use the crimps, place one on the cable approximately 3 to 4mm below the end of the cables outer sheathing. Crimp the two ears of the ring flat using bull nosed pliers. Pull the cable back through the cable gland until the crimp ring's ears are fully located into the slots in the cable gland housing. Always leave unused cable glands sealed off using the (supplied) rubber plugs.



ELECTRICAL LIMITS

VOLTAGE LIMITS ON TERMINALS LV & N	
Maximum Supply Voltage	25VAC or 25VDC
Minimum Supply Voltage	18VAC or 18VDC

VOLTAGE LIMITS ON TERMINALS A & N	
Maximum Supply Voltage	260VAC
Minimum Supply Voltage	190VAC

POWERING THE F29

The power required to drive the F29 depends on the nature of the supply, AC or DC and on temperature. The table below gives the maximum power required from various supplies at 25°C. As temperature increases, the power required will reduce. For example, at 30°C the power requirement will be approximately 3% less than the values given in the table. The measurements expressed in the table represent the maximum required power with both relays 1 and 2 closed and the LCD backlight and all indicator lights on.

POWER REQUIRED TO DRIVE THE STANDARD F29	
24VDC Supply to LV & N	Maximum 68mA 1.63Watts
24VAC 50Hz Supply to LV & N	Maximum 108mA 2.34Watts
220VAC 50Hz Supply to A & N	Maximum 87mA 2.00Watts
240VAC 50Hz Supply to A & N	Maximum 94mA 2.54Watts

POWER REQUIRED TO DRIVE THE 12VDC F29-12	
With Both Relays Closed	68mA Max at 12VDC 0.81W
With One Relay Closed	52mA Max at 12VDC 0.62W
Quiescent State (relays open)	25mA Max at 12VDC 0.30W

IMPORTANT: When directly controlling a pump motor through relay 1, always link the HD terminal to relay 1 Normally Open terminal and make sure the maximum switched motor current never exceeds 10 Amps. On a pump motor P1 must not exceed 2.4kW.

RELAYS

The F29 houses 2 relays. Relay 1 has S.P.D.T contacts. Relay 2 has S.P.S.T normally open contacts. Relay 1 is normally regarded as the pump control relay and relay 2 is normally regarded as the alarm relay.

With the HD terminal linked to the NO terminal of Relay 1, the F29 can directly control a single phase motor up to 2.4kW via its NO contacts. Without the HD terminal link in place, relays 1 & 2 are limited to directly controlling a motor to 0.75kW. Both relays can control motors of any required size via interposing contactors.

MAXIMUM PUMP MOTOR LOAD FOR RELAY 1	
10A at 240VAC 2.4kW	Inductive Motor Load

REMOTE INPUT

***WARNING:** The low voltage source available at the LV terminal is non-isolated and must be regarded as operating at full mains potential whenever the F29 is powered from the mains. Relative to earth, the LV terminal is at mains potential.*

A mains voltage rated external switch with voltage free contacts such as a pressure switch, tank level switch or a set of external relay contacts can be used to control the F29. The supply to the external switch must be taken from the LV terminal of the F29 when the controller is powered from the mains or from a 24V source. The F29 must always be powered from the same source as the supply to external switch. The supply to the remote switch on the F29-12 (low voltage DC model) must be taken from the supply positive terminal. In all cases the external switch return wire must be connected to the Remote input (R) terminal on the F29. Relative to neutral, the supply to the external switch will range from 12 to 24 VDC or from 20V to 35V AC depending on the supply voltage.

***WARNING:** Never connect an external power source of any kind to the F29's remote input terminal.*

The remote switch can be installed some distance from the F29. The maximum distance is limited by cable resistance and capacitance. The total cable resistance must not exceed 5K Ohms with the remote switch closed. The total capacitance of the cable must not exceed 25nF with the remote switch open. Wires to the remote switch should be run separately from power carrying cables. Do not run the remote switch wires in a conduit that also contains power cables. Capacitive coupling between the adjacent cables may cause false triggering of the F29's remote input. For cable runs longer than 150 metres we suggest using 2 separate wires to reduce capacitive coupling between the adjacent wires. When set up this way cable resistance becomes the limiting factor for distance. The table below sets out the resistance of typical copper wire of various diameters.

Note that the cable resistance refers to the total resistance out to the remote switch and back, as measured at the controller across the 2 remote connection wires with the external remote switch closed.

EXAMPLE

A water tank is located 2000 metres from the F29. Two separate wires each 0.2mm^2 are run to the remote tank (total wire length is 4000 metres). The resistance as measured across the 2 wires back at the F29 (with the tank level switch closed) is 382 Ohms. This is well under the 5,000 Ohm limit. The remote input to the F29 will operate properly provided the wires are separated by sufficient distance that the capacitance between them is less than 25nF. Capacitance should be measured between the wires when the remote switch is open and it must be less than 25nF.

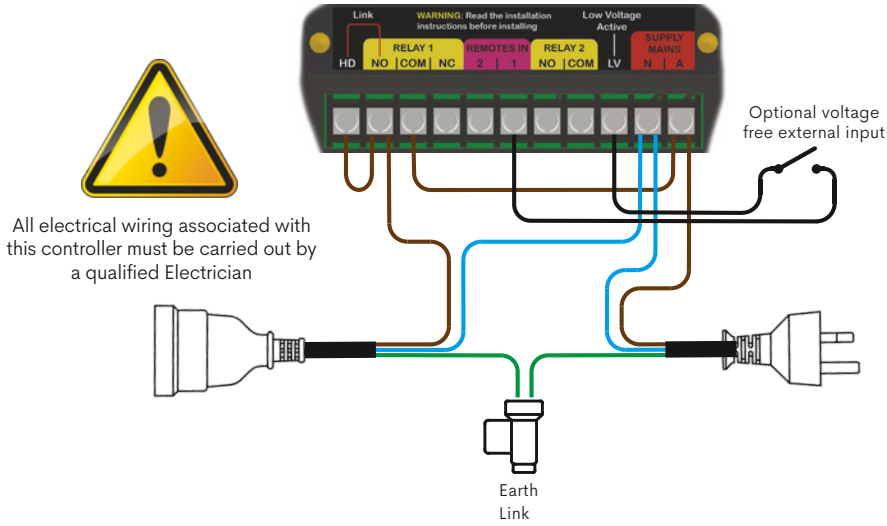
Cable Size square mm	Resistance Ohms /1000M
0.2	95.30
0.5	36.20
0.75	24.13
1.0	18.10
1.5	12.10

Note: Use table as a guide only, cable resistance may vary depending on the wire standard and construction.

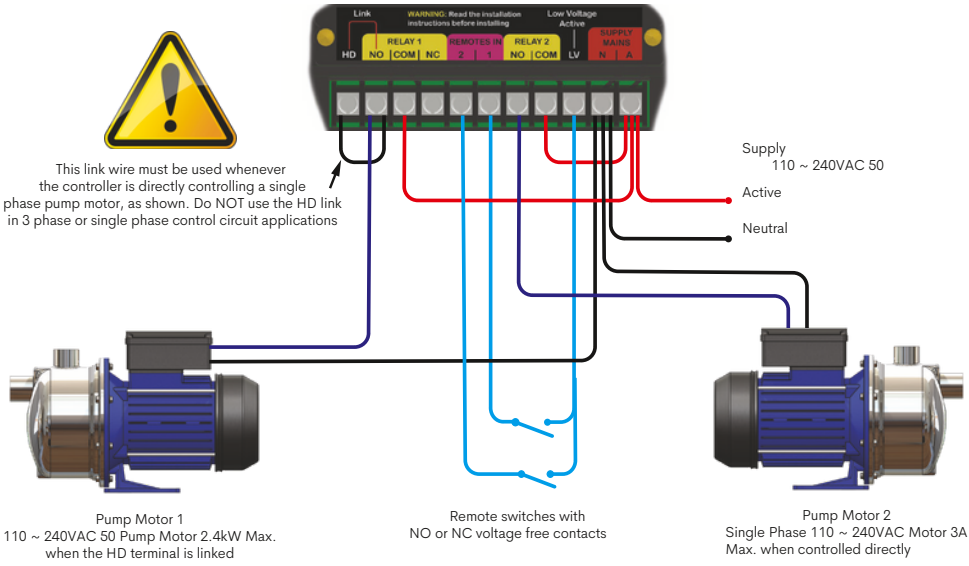
WIRING DIAGRAMS

PLUG & PLAY CONNECTIONS

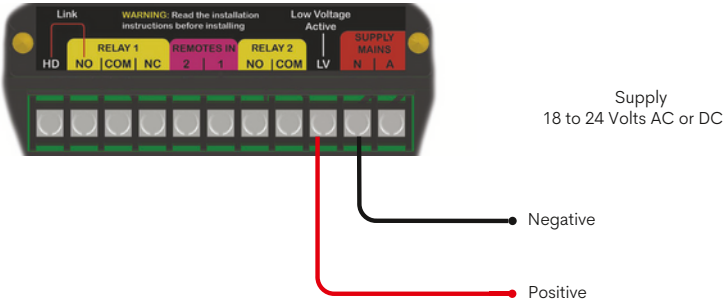
CONNECTIONS FOR A SINGLE PHASE PUMP



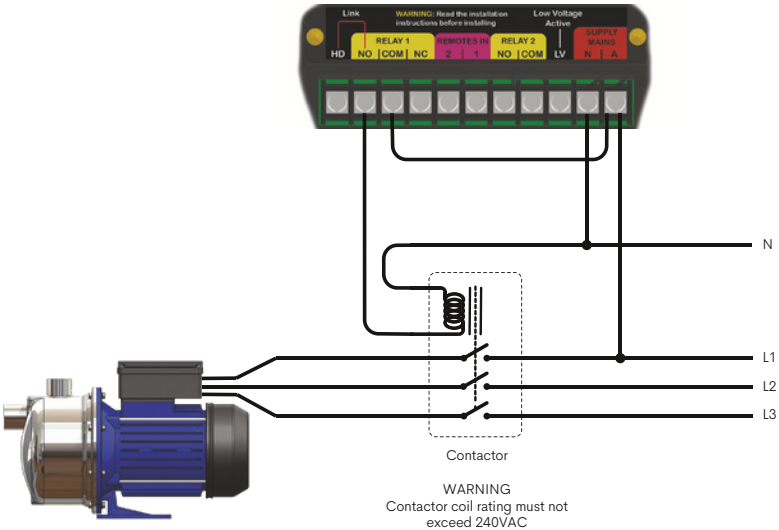
DUAL SINGLE PHASE PUMPS & 2 REMOTE INPUTS



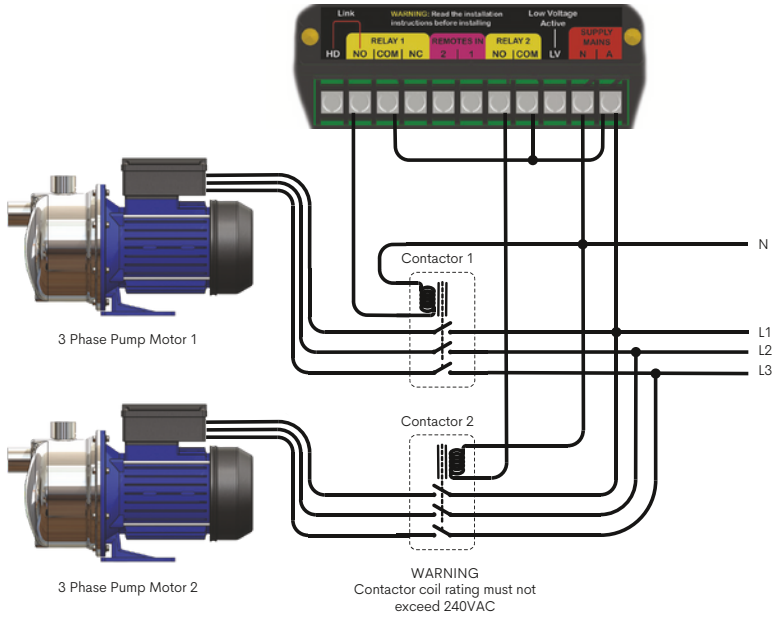
LOW VOLTAGE SUPPLY



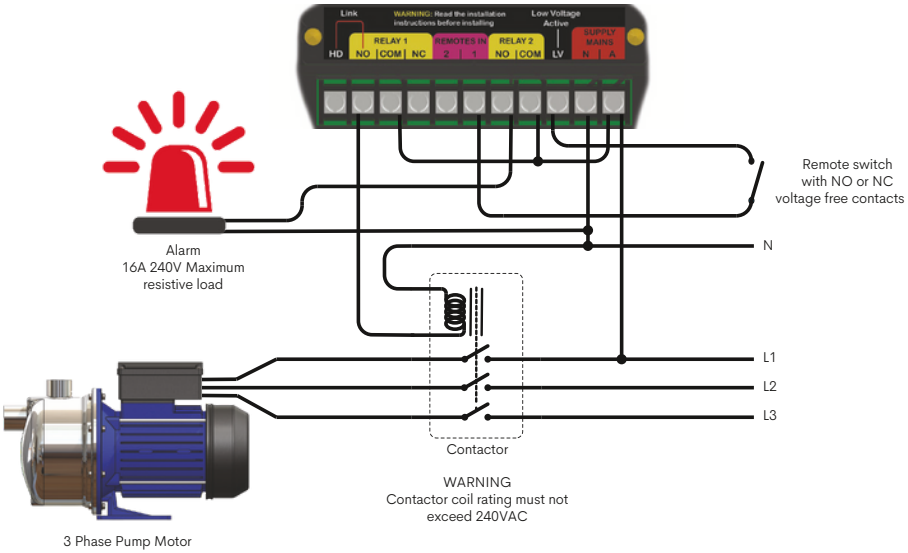
BASIC 3 PHASE PUMP CONTROL



DUAL 3 PHASE PUMP CONTROL



3 PHASE CONTROL WITH ALARM & REMOTE INPUT

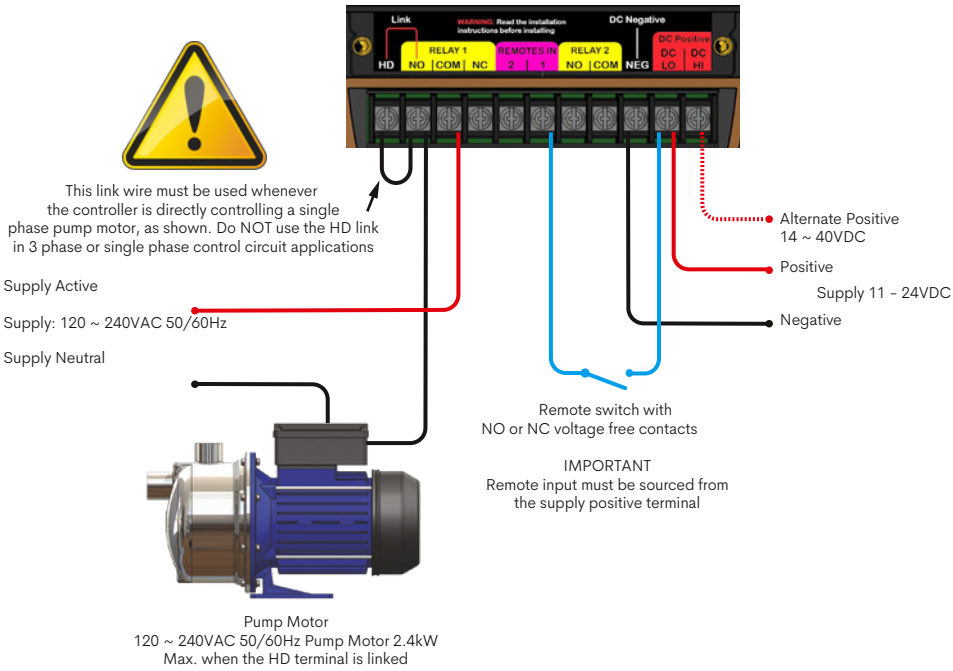


THE 12VDC F29 FLOW SWITCH

A low voltage DC version of the F29 MK3 is available for battery operation and for use in solar pumping systems. Functionally the 12V DC model is the same as the mains voltage model except for the terminal block markings. On the 12VDC model the active and neutral terminals are replaced by a positive + and a negative – terminal. Supply voltage across the positive and negative terminals must never exceed 24VDC or the flow switch will be damaged. The supply terminals are reverse polarity protected, however, the flow switch will simply not operate unless the supply polarity is correct.

If a remote switch is connected to the 12V DC F29 the supply to the remote switch must be taken from the positive terminal on the F29. The remote switch and its connecting circuit will then operate at 12VDC.

12VDC F29-12 CONTROLLING A SINGLE PHASE PUMP



PROGRAMMING THE F29 MK3

For a description of the functions of the buttons and lights please read pages 2 and 3 of this manual before proceeding.

RESTORING FACTORY DEFAULTS (Purging the Settings)

Provided the F29 is unlocked, you can restore it to its default factory settings by pressing and holding down the **(P)** button and pressing and then releasing the **(R)** button. Once the **(R)** button has been released, release the **(P)** button. The screen then displays **SETTING CLEARED PRESS P.** Doing this removes any settings you may have entered and restores the F29 to its original default state.

LOCKING & UNLOCKING THE F29

The F29 is supplied by the factory in an unlocked state and can be programmed using its buttons. To prevent unauthorised personnel from altering its settings, the programming button **(P)** can be locked.

LOCKING THE F29

To activate the lock, press and hold down the **(^)** and **(v)** buttons and then press and release the **(R)** button. Continue to hold the **(^)** and **(v)** buttons down until the screen displays **LOCK**. (takes about 2 seconds) release the **(^)** and **(v)** buttons. The F29 is now locked. When locked, pressing the **(P)** button will not allow access to the F29's menu, instead a message **PROGRAM LOCKED PRESS RESET** is displayed on the screen.

UNLOCKING THE F29

To unlock the F29 repeat the above procedure, press and hold down the **(^)** and **(v)** buttons and then press and release the **(R)** button. Continue to hold the **(^)** and **(v)** buttons down until the screen displays **UNLOCKED**. (takes about 2 seconds) release the **(^)** and **(v)** buttons

GETTING STARTED

1) Use the least number of functions possible. Do not program in functions you do not specifically require, as to do so will make the system's operation unnecessarily complicated and may introduce unpredictable interactions between the various functions.

2) When changing major settings always start by purging the previous settings to restore factory defaults before proceeding (see page 3). This ensues no conflicts occur between previously set functions and new functions.

With the F29 powered up, Press the (P) button. Hold it down for 1 second and then release it.

Kelco www.kelco.com.au This is the first screen in the menu.

Press and release (P) again.

F29 MK3 Controller Version 000000 The version number must match the number on the cover of this book.

Press and release (P) again.

USE REMOTE INPUT

If a remote input switch is connected to the F29 select yes to this question by pressing the button. Press the **(P)** button to lock your choice into memory and to move to the next screen. You are then presented with a choice of 3 ways the remote input can be configured. Press the **(^)** or **(v)** buttons to move from one option to the next.

USE REMOTE FOR START & STOP

Select this option if you are using a 2 position high / low tank level switch to control the F29. The F29 will be on when the remote switch is closed and off when the remote switch is open.

USE REMOTE FOR START ONLY

Select this option if you are using a momentary contact switch or relay to trigger the F29 and cause it to start. The remote switch can open its contacts once the F29 has started or they can remain closed.

USE REMOTE FOR SYSTEM RESETTING

This selection replicates the function of the **(R)** button. Momentary closing of the remote contacts causes the F29 to reboot.

USE ALARM RELAY

The F29 houses 2 output relays. Relay 1 is normally used to control a pump. Relay 2 is normally used as an alarm relay. Selecting yes to this question allows you to configure the alarm relay to close its contacts under various conditions. If you want to use the alarm relay press **(v)** and then press **(P)**. Use the **(^)** or **(v)** buttons to move from one option to the next.

CLOSED IF ANY FAULT DEVELOPS Closed only on a genuine fault, open at all other times.

CLOSED ONLY IF FLOW STOPS Closed when the F29 detects no flow, open at all other times.

CLOSED WHENEVER PUMP IS OFF Closed when the pump is stopped, open when the pump is running.

CLOSED WHENEVER PUMP IS ON Closed when the pump is running, open when the pump is stopped.

CLOSED DURING PRE-START DELAY Only closed while the pre-start delay timer is running.

CLOSED ON FAULTS NOT IN CYC RUN Closed on all faults except those detected during cyclic running.

CLOSED ON FLOW OPENS ON NO FLOW The relay contacts mimic the action of a simple on/off flow switch.

START ADDITIONAL EQUIPMENT This option works in conjunction with the pre-start delay timer to allow control of staged equipment. Consider an F29 powered by battery with a generator set connected to the alarm relays contacts and the output of the generator connected to a pump via the F29's pump control relay (Relay 1). The generator will start if the reset button **(R)** on the F29 is pressed. The generator will then run for whatever time is set on the pre-start delay timer, after which the pump will start. The contacts of the alarm relay remain closed holding the generator set on while ever the pump runs. If flow stops the pump will shut down. The alarm relay will then open its contacts and shut the generator set down.

START-UP TIMER

On power-up the start-up timer ignores the F29 paddle and allows the pump to start despite an initial lack of flow. The start-up timer is factory set to 5 seconds. This can be adjusted using the **(^)** or **(v)** buttons to any required value between 0 and 900 seconds. The time chosen must be sufficient for flow to actuate the F29 paddle before the timer times out. The start-up timer is self-terminating and ceases its run as soon as flow is detected. If the start-up timer times out without detecting flow, the pump will instantly shut down.

RUN-ON TIMER

If flow is lost during normal operation, the F29 uses its run-on timer to keep the pump running. The run-on timer is factory set to 5 seconds. This can be adjusted using the **(^)** or **(v)** buttons to any required value between 0 and 900 seconds. If the run-on timer is running it means no flow is being detected and the pump is possibly running dry. It is therefore important to keep the run-on period to a minimum. The run-on timer is self-terminating and ceases its run as soon as flow is detected. If the run-on timer times out without detecting flow, the pump will instantly shut down.

ADVANCED CONTROL OFF

The F29 includes a set of advanced functions that extend the capability of the flow switch well beyond basic loss of flow protection. The advanced functions are directly accessible by moving beyond the more basic start-up

and run-on timers previously described. To access the advanced functions press **(^)** followed by **(P)**.

If you do not require advanced functions press (P). You are then presented with a screen asking you to accept the current settings and exit the menu and run the pump.

PRE-START DELAY TIMER

The pre-start delay timer delays the starting of the pump each time the F29 is powered up. The range of adjustment is 0 to 64,800 seconds (zero to 18 hours) in 1 second increments. As soon as the set time has elapsed the pump will start and run normally. The pre-start timer can be used to allow peripheral equipment time to boot up or to run prior to running the pump.

It can also be used to sequence or stage the starting of multiple pumps in sequential or cascaded transfer pumping systems. Starting pumps sequentially rather than all at once in such systems greatly reduces the current draw on the power supply and ensures each pump spins up to full speed before the following pump starts.
To use the pre-start delay timer, press **(^)** followed by **(P)**. Use the **(^)** or **(v)** button to enter a suitable delay period. The display increments up in 60 second steps and down in 1 second steps. Press **(P)** to lock your selection in and move to the next screen.

BATCH CONTROLLER

The F29 can be set to run a pump for a set time, called a batch. The batch run time can be from 1 minute to 99 hours 59 minutes in increments of 1 minute. To use batch control press **(^)** followed by **(P)**.

SINGLE BATCH

Press **(P)** to select this option or press the **(v)** button to move to the next option.

REPEAT BATCH

Means batch runs that repeat with an automatic delay between each batch. Selecting repeat batch enables delayed restarting, a function that follows batch control in the menu. If the batch run is interrupted by loss of flow it can be set to restart at the beginning of its run after a delay period that is set in the delayed restart function. If you select single batch from the menu, delayed restarting does not appear in the menu as an option.

The running of the batch can be initiated by powering up the F29 or by pressing the **(R)** button. The batch run can also be initiated by the closing of the contacts of a remote switch connected to the F29's remote input. To use the batch controller in this way, first set the remote input to on and to start only. Each time the remote switch closes its contacts a batch run will be initiated. If the remote switch contacts remain closed the F29 simply runs for the set period and then shuts down. To initiate another run the remote switch contacts must first open and then re-close. If flow is lost during a batch run the F29 will shut down the pump. If flow subsequently resumes the batch controller will re-initiate its run from the beginning. It will not resume running from the point in its previous run that it shut down at. This function can be used in tank filling applications to send a set volume of water to a tank but to terminate the batch run when the tank fills.

DELAYED RESTARTING

If you set this option to on, each time the pump stops the F29 will prevent the pump from restarting for the set period. The delay can be set from zero to 99 hours 59 minutes in increments of 1 minute. Its uses include preventing rapid cycling if the system's air cell becomes water logged or if a fault develops in a system's external pressure switch. As an example of its use, consider a pressure system filling a remote tank. If the tank has a float valve that shuts when the tank is full, then the system will pressurise and shut down each time the tank fills and the valve closes. If the float valve leaks or the level drops and the valve opens the system will depressurise and the pump would ordinarily start. Delayed restart will prevent the pump from restarting for a set time.

AUTOSTART AFTER DELAY

If you choose yes to this question the F29 will automatically start the pump at the end of the delay period. If you choose no, the flow switch will only start the pump after the delay if an external switch connected to the F29's remote input closes its contacts. In the example outlined above, consider a tank that has intermittent or irregular draw off. You may choose to set the delayed restart to perhaps 12 hours. At the end of the 12 hour period the pump will automatically start and if the tank level is low, the pump will run continuously until the tank fills and the float valve in the tank closes.

If, however, there has been no draw-off from the tank during the 12 hour period, the automatic restart at the end of the delay will start the pump and run it for whatever period you have set on the start timer. The F29 will sense no flow because the float valve will still be closed. The F29 will then shut down the pump and again wait for 12 hours before again attempting to start the pump. Using this technique prevents the pump from hunting on and off when the tank is full because of slight leakage from the float valve or pipework. It allows you to set the pump to only operate after a chosen delay, and if there has been no usage of water, to test the system for demand by momentarily starting, and only run the pump if there is a genuine call for water.

CYCLIC RUNNING

The F29 can be programmed to run and stop a pump for set periods of time. Both the running and stopping times can be set to any value you choose from 1 minute to 99 hours 59 minutes in increments of 1 minute. The cyclic running option is highly flexible. The run and stop timers are totally independent of each other. If a set running and stopping time are programmed in, the flow switch will run the pump for whatever time it is set to and then stop for the time set on its stop timer. If a run time is set to some value and the stop time is left set at zero, the flow switch will behave as a one-shot batch controller. On pressing the reset button or switching the pump on, the pump will run for the set period and then shut down. It will not then restart until you again press the reset button or reset the power to the unit. In cyclic running the flow switch monitors the elapsed time and displays the remaining time on its LCD screen in hours and minutes.

Cyclic running allows low yield bores to be pumped to their maximum capacity. A bore pump running under cyclic control can be set to pump the bore down to a low level, stop and wait for the standing water level to recover and then repeat the process endlessly. For transfer pumping applications, cyclic running can be used to automatically top up remote tanks without the need for float valves or level control at the tank. It can also be used for one-shot tank filling. Press the reset button and pump a set number of hours of water to a tank, and then stop until the reset is again pressed.

AUTO RESTART

If the F29 is used in conjunction with an external pressure switch that is connected to its remote input it will be able to detect if the pump has run dry as a combination of no flow and low or no line pressure. If the pump does run dry the auto restart function can be set to automatically restart the pump after a settable time. ***Note that the auto restart function only appears in the F29's menu if you have first selected to use the remote input and have selected "start only" from its options.***

If auto restart is chosen, the F29's menu presents you with a choice, single restart or repeated restarts. Single restart will attempt to restart the pump after a set time and if the attempt fails the F29 then shuts down the pump and goes into permanent alarm mode. If it finds flow when it restarts it resumes normal operation. If you choose repeated restart from the menu the F29 will repeat the shut down and wait sequence and it will not go into permanent alarm mode. Once you choose repeated restart or single restart the screens that follow ask you to enter a waiting period in hours and minutes. The range of adjustment is 1 minute to 99 hours 59 minutes in one minute increments. If the pump runs dry the F29 will shut it down and wait for the period you have set before attempting to restart. The ability to restart the pump automatically if it runs dry can be a very useful function. Consider a submersible pump installed in a low yield bore. The bore can be pumped until dry and the F29 can be set to shut down the pump as soon as loss of flow is detected and then wait until the standing water level in the bore recovers before attempting to restart and again pump the bore down.

ANTI-CYCLING

Electric motors are often limited in the number of times they can be safely started in any one hour. This is particularly important in the operation of submersible bore pumps. When a motor starts there is an initial inrush of current that produces heat in the coils and iron rotor of the motor. If the frequency of starts is excessive the accumulation of heat within the motor can cause severe damage and eventual failure of the motor. Submersible bore pump motors are particularly prone to damage from excessive cycling (starting and stopping).

MAXIMUM STARTS PER HOUR

The anti-cycling option built into the F29 allows the user to set the maximum number of times the pump can be safely started in any one hour period. If you select yes to this option the screen that follows will ask you to enter the maximum number of times the pump can be started in any one hour. The number of starts can be set from 1 start per hour to 1800 starts per hour. Please contact your pump supplier to obtain the correct figure for your specific pump. In operation, the anti-cycling system monitors both time and the number of starts and compares the two. If the starts per hour rate is exceeded for a settable number of consecutive times in any one hour period the pump will be automatically shut down and the controller will display a message indicating the starts per hour rate was exceeded.

NUMBER OF STARTS IN SEQUENCE

After setting the required number of starts per hour and pressing **(P)** you are asked how many starts in a row you are prepared to accept. The default setting is 5 starts. This can be adjusted between 2 and 50 starts. Assuming you accept the default of 5 sequential starts then as a simple example of the way the anti-cycling system works, if starts per hour rate is set to 360 (one start every 10 seconds maximum) and the pump started 4 times in a row at less than 10 seconds between each start and then did not start again for 12 seconds the anti-cycling shutdown will not be invoked. If, however, the pump was to start 5 times in a row with less than 10 seconds between the starts the anti-cycling system would be invoked and the pump will shut down. In a conventional pressure system, the anti- cycling function can be used to protect the pump from damage in the event of the system's air cell losing its air charge. If air is lost from a system's air cell due to a ruptured diaphragm or leaking air valve, the pump will hunt on and off rapidly. Such rapid cycling will cause the pump to overheat very quickly. Anti-cycling can also be used in conjunction with burst pipe detection. Burst pipe detection is an effective guard against a burst pipe. Anti-cycling is effective at detecting a split pipe that causes a pump to cycle on and off.

BURST PIPE DETECTOR

Note: The burst pipe detector requires an external pressure switch connected to the F29's remote input to detect loss of pressure. It is commonly used in pressure systems to detect excessive run time due to a burst pipe.

If a pressure system bursts its discharge pipe the pressure will fall and the pump will start when the external pressure switch closes. The pump will then run continuously until the water source is depleted. The burst pipe detector is a timer that times out for a settable period each time the pump runs. The timer resets each time the pump stops. The timer can be set from zero to 99 hours 59 minutes in steps of 1 minute. In a typical application, the burst pipe detector would be set to a time that was marginally longer than the longest time the pump would ordinarily run. Each time the pump switches on the burst pipe detector begins to count down. In normal circumstances the pump will shut down in less than the burst pipe detector's set time. This resets the burst pipe detector's timer back to its original setting. If, however, the pump continues to run, due perhaps to a burst pipe, it will eventually reach the set point. The pump will then be instantly shut down preserving whatever source water remains, or at least reducing the discharge flow by an amount equal to the pump's capacity. The F29 will then display "burst pipe detected" on its LCD screen.

LEAK DETECTOR

The leak detector only appears in the menu if you previously elected to use the remote input and set it to start only. The leak detection system will only operate in systems where the F29 is connected to an external pressure switch as it relies on the opening and closing of the pressure switch contacts to count pump starts.

To use the leak detector, open all valves feeding into the pipe system to be tested. Close all valves at the far ends of the pipework so the pipe system can be pressurised. Press the reset button on the F29, this will zero the leak detector screen and run the pump until the system is fully pressurised. Leave the system unattended for at least an hour. On returning to the system, the F29's LCD screen will be displaying the number of times the pump started and the total run time in hours minutes and seconds since

the time the leak detector was zeroed. If the leak detector screen displays no starts and no run time, then no leak has occurred from the system in the interim period. If the screen displays a number of starts and a total run time, a leak has occurred and the magnitude of the leak can be assessed by considering the total run time displayed and the capacity of the specific pump. The leak detector can be used in any pressurised pumping system of any size.

ACCEPT SETTINGS

This is the end of the menu. Select yes to confirm all your previous settings or use the buttons to select no to return to the top of the menu. If you accept yes and press **(P)** you are then asked to press the reset button to start the pump. The F29 will start the pump and attempt to run the system using the settings you have programmed in. If the settings you have initially made prove unsatisfactory then simply pressing and holding down the **(P)** button for about 1 second and then releasing it will shut the pump down and take you to the top of the main menu where you can step through the settings and make appropriate changes.

RUNNING TIME DISPLAY

The F29 keeps track of how long a pump under its control runs for. The total for any given run is displayed on the LCD screen each time the pump stops. This information is displayed along with any other relevant information about the state of the pump or the reason for the shutdown by alternating the information at 5 second intervals on the LCD screen while the pump is off. The time display is in minutes and it accumulates while ever the pump runs. The time resets to zero each time the pump starts or the reset button is pressed or each time power is reset.

THE HOUR METER

The F29 includes an hour meter that keeps track of the total time a pump runs for. The hour meter displays the total hours run for 2 seconds each time the pump stops. It is viewable by watching the LCD screen carefully during this 2 second period as the F29 shuts the pump down.

The hour meter can also be viewed and reset to zero from within the menu. Press the **(P)** button to access the menu and press it again to display the controller's model number screen. With the display showing **F29 CONTROLLER**, press the **(^)** button and the hour meter will display. The

time displayed on the hour meter represents the actual hours the pump has run for in total. To reset the hour meter to zero, press the **(v)** button. To exit out of the hour meter screen press **(P)**. The hour meter accumulates running time and does not lose its memory of the total pumping hours even if the power is switched off for extended periods. The meter can accumulate up to 7.4 years of total running time before it automatically resets to zero.

MAINTENANCE

The F29 is a minimal maintenance device. If it is correctly installed in a location that is out of direct exposure to the elements it should give a long and reliable life and require no maintenance at all. Factors that may reduce its life are lightning strikes or power surges, failure to fully tighten its lid and cable glands, exposure to pressures or temperatures in excess of its ratings and operation outside its electrical limitations in terms of supply voltage and motor loads.

SPARE PARTS

Spare paddles are available for the F29 flow switch from your supplier.



If the F29 Programmable Flow Switch is used in a manner not specified by the manufacturer the pump protection provided by the F29 may be impaired or negated. In addition, all warranties stated or implied may be rendered invalid.