

PROTECTION AND CONTROL PANELS FOR SUBMERSIBLE PUMPS

Maximum protection without level electrodes and level relays

- Simple, very low cost installation
- Suitable for both old and new installations

How should submersible pumps be installed to prevent failures?

- 1. Without level electrodes and level relays but avoiding dry running
- 2. With motor protection against overloads with thermal memory
- 3. With electronic protection against overvoltage, phase loss and incorrect phase sequence
- 4. With short-circuit protection

The facts

Submersible pumps **must never work in a "dry running"** situation to work properly.

This protection function is usually carried out by level electrodes and level relays.

This system is very unreliable, due to the varying amounts of minerals in water, which can lead to rapid damage of level electrodes in water with high mineral levels.

The built-up of sludge or particles on the electrodes, low water conductivity,etc. also lead to failure in detecting water levels.

Other breakdowns can occur through phase loss or incorrect phase sequence in three-phase pumps or voltage increase in single-phase pumps.

Any of these problems may leave pumps out of service, thus causing the user very significant losses.

The ideal solution...

FANOX control panels for electronic protection of three-phase and single-phase submersible pumps provide a comprehensive solution to these problems by using the motor as a sensor.

They detect the absence of water and act before dry running occurs by measuring the motor's parameters. This is achieved without the need of awkward level electrodes, thus **saving time and money in their installation**

They also protect the motor against overload, <u>blocked</u> rotor, overvoltage, <u>phase</u> loss and incorrect phase sequence.

Once the pump has stopped, the control panel waits a certain time (adjustable reset time by the user) before restarting it

...also suitable for old installations

Faulty level electrodes in an installation that is already operating may mean the costly work of removing the pump from the well, even when it is working properly. In this case, the problem can be solved by replacing the old panel with a FANOX panel, without having to remove the pump.

PROTECTION RND CONTROL PRNELS FOR SUBMERSIBLE PUMPS

They protect pumps against dry running without using level electrodes.

- Maximum protection without level electrodes or level relays
- Electronic relay incorporated
- Quick and easy installation, maintenance-free
- Installation costs are significantly reduced
- Can be adapted to installations already in service

	Ν	D	E	×				
Protectio	on panels			2				
Cost con	nparison_			3				
Panels for Single-phase pumps								
Panels fo	or Three-p	ohase pumps		6				
Panels fo	or Three-p	ohase pumps						
with soft starter								
Electronic relays for pump protection								
Soft starters12								

891



protection & control

PROTECTIONRNDCONTROL"

PRNELS FOR SUBMERSIBLE PUMPS

Fanox offers a comprehensive range of single-phase and three-phase panels for application in the extraction of water using submersible pumps in domestic, industrial and agricultural installations.

It is possible to detect the load status of the pump by measuring the Cos Φ value at three-phase pumps. By monitoring this value, dry running can be detected and the pump stopped before this situation occurs.

The same protection is reached at single-phase pumps, monitoring the motor current.









PROTECTIONPRNEL SINGLE-PHRSE PUMPS

One of the most critical situations in pump operation is dry running. The solution offered by FANOX single-phase protection panels is based on measuring the undercurrent. In dry running situations a decrease in current consume is detected. This reduction in the current consumed is measured by the PS electronic relay fitted to the protection panel; when the preset undercurrent value is reached, it switches off the pump.

MRIN SPECIFICATIONS

- F

Protections against:	
Dry running by monitoring undercurrent	I<
Overload with thermal memory	<i>I></i>
Overvoltage(+15%)	<i>U</i> >
Short-circuit	I≫

- \neg Thermal memory that memorises heating and cooling cycles of the motor
- ¬ Automatic reset, adjustable from 2 to 240 minutes for well filling
- ¬ Indication of tripping cause.
- ¬ Control point for pressure switch, buoy, programmer...
- ¬ Includes:circuit breaker 1P+N, PS electronic relay contactor, LEDs and on/off switch.f.

DIMENSIONS

¬ Plastic case with transparent lid, 230x250x150mm.

Models	Code	Approx. motor current	Power of phase 230	f single-) V motor	Adjustable well filling time	
		(Amps)	HP	kW	(minutes)	
CBM-2	12312	3 - 11	0,5 - 2	0,37 - 1,5	2 - 70	
CBM-3	12314	11 - 16	2 - 3	1,5 - 2,2	2 - 240	

¬ Equipment with halogen-free wiring



CBW-2

¬ IP54



CBM-3

¬ IP54



ROTECTIONPRNEL THREE-PHRSE PUMPS

The cosine of Φ (Cos Φ) is the value of the cosine of the phase angle between the voltage and the intensity of the electrical current. This oscillates from a value slightly below 1 for a full load operating motor at to almost 0 when it is dry running.

Therefore, in dry running situations, cos Φ falls significantly. This reduction is monitored by the PF relay built-in FANOX three-phase protection panels, meaning that when it falls beneath the adjusted value, the panel shuts down the pump and avoids any damage.

MRIN SPECIFICATIONS

¬ Protection against:
Dry running by monitoring the cos φ
Cos φ
Overload with thermal memory
Phase loss/imbalance
Incorrect phase sequence
Short-circuit.

- ¬ Thermal memory that memorises heating and cooling cycles of the motor
- ¬ Automatic reset for well filling and adjustable from 2 to 75 minutes. It can be extended to 525 minutes by using the PF-RM module(see Page11)
- Cause of tripping Indication
- Control point for pressure switch, buoy, programmer...
- ¬ Includes: circuit breaker 3P or 3P+N, PF electronic relay, contactor, LEDs and on/off switch
- \neg Models with a metal case also include, voltmeter, ammeter and $\, \phi$ meter

	Models Code		Approx. motor current	Power of phase 40	the three-)0 V motor	Adjustable well filling time	Dimensions
			(Amps)	HP KW		(minutes)	(11111)
	CBT-1	12301	1,1 = 2,0	0,5 - 1	0,37 - 0,75	2 - 75	230x250x150
	CBT-2	12302	2,8 - 3,8	1,5 - 2	1,1 - 1,5	2 - 75	230x250x150
ЦС	CBT-5	12305	5,5 - 9,5	3 - 5,5	2,2 - 4	2 - 75	230x250x150
LAS ⁻	CBT-7	12307	13	7,5	5,5	2 - 75	230x250x150
4	CBT-10	12310	16,5	10	7,5	2 - 75	230x250x150
	CBT-15	12315	24	15	11	2 - 75	230x250x150
	CBT-20M	12316	32	20	15	2 - 75	500x400x200
/	CBT-25M	12317	40	25	18,5	2 - 75	500x400x200
TAL	CBT-30M	12318	47	30	22	2 - 75	600x400x200
ME	CBT-40M	12319	64	40	30	2 - 75	600x400x200
	CBT-50M	12320	79	50	37	2 - 75	600x500x200
	CBT-60M	12332	92	60	45	2 - 75	600x500x200

 * Up to 525 minutes with the PF-RM module.

¬ Equipment with halogen-free wiring



CBT

- Up to 15 HP, plastic case with transparent lid

¬ IP54



CBT-M

¬ From 20 HP, metal case

¬ IP55





FANOX protection panels with progressive startup and shut-down are fitted with ES soft starters that avoid problems caused by water hammering or sudden start-ups and shut-downs.

Protection against dry running is provided by the PF relay that monitors the value of $\cos \phi$ and shuts down the pump when it falls below the selected value.

MRIN SPECIFICATIONS

Protections against:	
Dry running by monitoring $\cos { \phi }$	COS φ
Overload with thermal memory	I>
Phase loss/imbalance	٨
Incorrect phase sequence	(63)
Short-circuit.	I>>

- Functions:

neerono.		
Soft start		
Soft stop		

 \langle

- \neg Thermal memory that memorises heating and cooling cycles of the motor
- ¬ Automatic reset for well filling and adjustable from 2 to 75 minutes. It can be extended to 525 minutes by using the PF-RM module (see Page11)
- Cause of tripping Indication
- ¬ Control point for pressure switch, buoy, programmer...
- ¬ Metal case
- ¬ Includes: circuit breaker 3P+N, PF electronic relay, ES soft starter, contactor, LEDs and on/off switch.

	Models Code		Approx. motor current	Power of the 400 V three-phase 4 motor		Adjustable well filling time	Dimensions	
			(Amps)	HP	kW	(minutes)	(11(11()	
	CBS-2	12321	3,8	0,5 - 2	0,37 - 1,5	2 - 75	400x300x200	
	CBS-3	12322	5,5	3	2,2	2 - 75	400x300x200	
	CBS-5	12323	7,0 - 9,5	4 - 5,5	3 - 4	2 - 75	400x300x200	
	CBS-7	12324	13	7,5	5,5	2 - 75	500x400x200	
TAL	CBS-10	12326	16,5	10	7,5	2 - 75	500x400x200	
ME	CBS-12	12327	21	12,5	9,2	2 - 75	500x400x200	
	CBS-15	12328	24	15	11	2 - 75	500x400x200	
	CBS-20	12329	32	20	15	2 - 75	600x400x200	
	CBS-25	12330	40	25	18,5	2 - 75	600x400x200	
	CBS-30	12331	47	30	22	2 - 75	600x500x200	

* Up to 525 minutes with the PF-RM module.



CBS

- ¬ Metal case
- ¬ IP55



FOR PUMP PROTECTION

The PS and PF electronic relays have been specially designed to provide complete protection for both single and three-phase pumps and any other system where dry running is a critical factor..

The great advantage of these relays is that they use the motor itself as a sensor and do not need any additional external sensors. They monitor the load of the motor and stop it before any expensive damage is caused by dry running.

The relays also memorise the thermal image of the motor during heating and cooling cycles to provide effective protection against overload.

Other useful features include protection against phase loss and imbalance, overvoltage and detection of the phase sequence to ensure that the motor does not rotate in the opposite direction.

Some of the most common applications in domestic, industrial and agricultural installations are as follow:

- ¬ Submersible pumps: water supply, irrigation, well dewatering, petrol stations...
- Surface pumps: sewage treatment plants, swimming pools, pressure sets, fire-fighting equipment...
- Other typical applications that require monitoring: belt drives, ventilators, conveyor belts....







PS SINGLE-PHRSE RELRYS

- \neg Dry running (underload by undercurrent)
- \neg Overload with thermal memory
- ¬ Overvoltage (+ 15%)

- *I*< ¬ Indicates cause of tripping
- *I*> ¬ Automatic and remote reset
- *U*> ¬ Voltages: 115 and 230 V, 50/60 Hz.

Models	Code	Range I _B	Motor 230 V 50 Hz		Reset I< adjustable
Models	COUE	(A)	HP	kW	(minutes)
PS11-R	12164	3 - 11	0,5 - 2	0,37 - 1,5	2 - 70
PS16-R	12163	3 - 16	0,5 - 3	0,37 - 2,2	2 - 240

0

PF THREE-PHRSE RELRYS

- \neg Dry running (underload by **cos** φ)
- \neg Overload with thermal memory
- \neg Phase loss/imbalance
- \neg Incorrect phase sequence

cos φ	- I
<i>I></i>	_ /
*	¬ ۱
((*))	

¬ Indicates cause of tripping

- ¬ Manual and automatic reset
- \neg Voltages: 230 and 400 V, 50/60 Hz

	Models	Motor 400 V	Motor 230 V	Range I	Motor 40	0 V 50 Hz	Reset cos φadjustable
	models	Code	Code	(A) ^B	HP	kW	(minutes)*
	PF16-R	12165	12173	4 - 16,7	3 - 10	2,2 - 7,5	2 - 75
	PF47-R	12167	12168	15 - 47	10 - 25	7,5 - 18,5	2 - 75

 * Up to 525 minutes with the PF-RM module.

ep

11



Optional plug-in accessory as a 22 mm diameter button that allows you to visualise the status of the relay and reset it from outside the panel. Ref.: 12555

02 PF-RM

For resets between 75 and 525 minutes we need to incorporate the PF-RM timer module to the FANOX three-phase protection relay for Ref.: 12169

ES soft starters offer the best protection against premature ageing of pumps and mechanical components.

SOFTSTARTERS

By using soft starters we can avoid sudden startups, stops and water hammering, significantly reducing damage to pump bearings and gears, as well as other components of the installation.

RPPLICATIONS

Their wide range of applications includes

- Pumps
- Cooling compressors
- ¬ Conveyor belts, elevators, etc.
- ¬ Stirrers and mixers

FUNCTIONS

		-	
٦	Soft start		,
٦	Soft stop	~	
٦	Phase loss/imbalance	Ļ	
٦	Incorrect phase sequence	(7))
_	Overheating of the motor	-	

Models	Code	Approximate motor current	Rated voltage (V) ±15% 50/60 Hz	Power of the three-ph	Functions	
		(Amps)		HP	kW	
ES400-3	41803	3	400	1,5	1,1	~~
ES400-12	41812	12	400	7,5	5,5	~~
ES400-25	41825	25	400	15	11	<u>~</u> ~
ES400-45	41845	45	400	30	22	 人 异 (6)







RDVRNTREES

ES400-3 ES400-12

The main advantages of these items are:

- \neg They avoid sudden increases in pressure with applications using compressors and pumps. They reduce water hammering.
- Compact design that allows easy assembly, adjustment, installation, start-up and maintenance.
- ¬ They reduce initial torque during start-up and stop, thus eliminating mechanical problems.
- ¬ They do not require additional cooling as a by-pass relay is incorporated.
- ¬ They replace conventional contactors: one for direct start-up and three for star-delta start-up.
- Less current and voltage drop during start-up allow lower energy supply contracts.





protection & control

PAE Asuaran - Edif. Artxanda, 23. 48950 Erandio (Spain) tel.: (+34) 94 471 14 09//fax.: (+34) 94 471 05 92 fanox@fanox.com

MMM.ENNOX.COM

SA