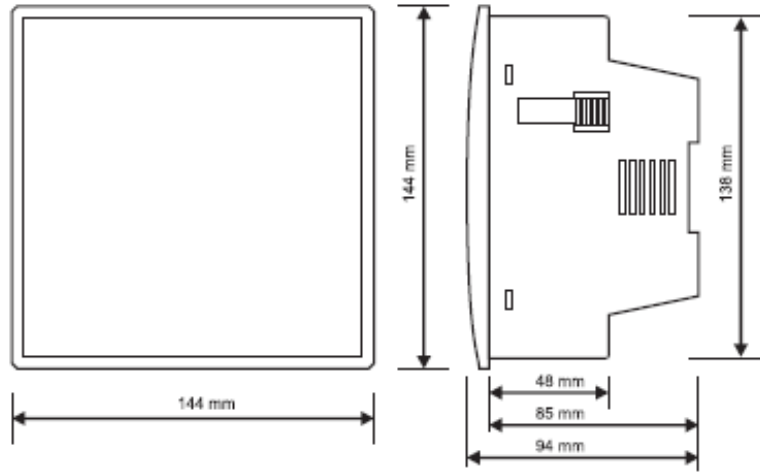


## 7-Warnings:

- Make the connections of the device according to the diagram.
- Connect the pump casing to the ground line.
- **Make sure that the liquid is not flammable or explosive.**
- When two electrodes are in use, the upper and lower electrodes are shorted out and used together with the base electrode.
- Make sure that the temperature of the place where the device is mounted is not below -5°C.
- Do not expose the front panel of the device to direct sunlight. Otherwise LCD screen will fade out by time.
- Never energize the floater terminals of your device (tank).

## 8-Dimensions:



## 9-Technical Specifications

Specifications	TDK-01max. 120A	TDK-02 max. 300A	TDK-04
Rated Voltage	260V - 470V AC	260V - 470V AC	260V - 470V AC
Operating Frequency	50 Hz.	50 Hz.	50 Hz.
Operating Temperature	0°C - 55°C	0°C - 55°C	0°C - 55°C
Power Consumption	<6VA	<6VA	<6VA
Operating Current Range	1A - 120A	5A - 300A	200mA - 5.5A
Panel Hole Dimensions	139 x 139 mm.	139 x 139 mm.	139 x 139 mm.
Weight	0.8 Kg.	0.8 Kg.	0.8 Kg.
Connection Type	Terminal Connection	Terminal Connection	Terminal Connection
Output Contactors	5A, 250VA	5A, 250VA	5A, 250VA
Metering Screen	4x20 LCD, Led	4x20 LCD, Led	4x20 LCD, Led
Cable Diameter	1,5 mm <sup>2</sup>	1,5 mm <sup>2</sup>	1,5 mm <sup>2</sup>
Mounting	Front-mounted to the panel	Front-mounted to the panel	Front-mounted to the panel
Operating Altitude	<2000m	<2000m	<2000m

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## Tense Elektrik Elektronik Sanayii

### TDK-XX THREE-PHASE RELAYS FOR CONTROLLING PUMP MOTORS INSTRUCTION MANUAL



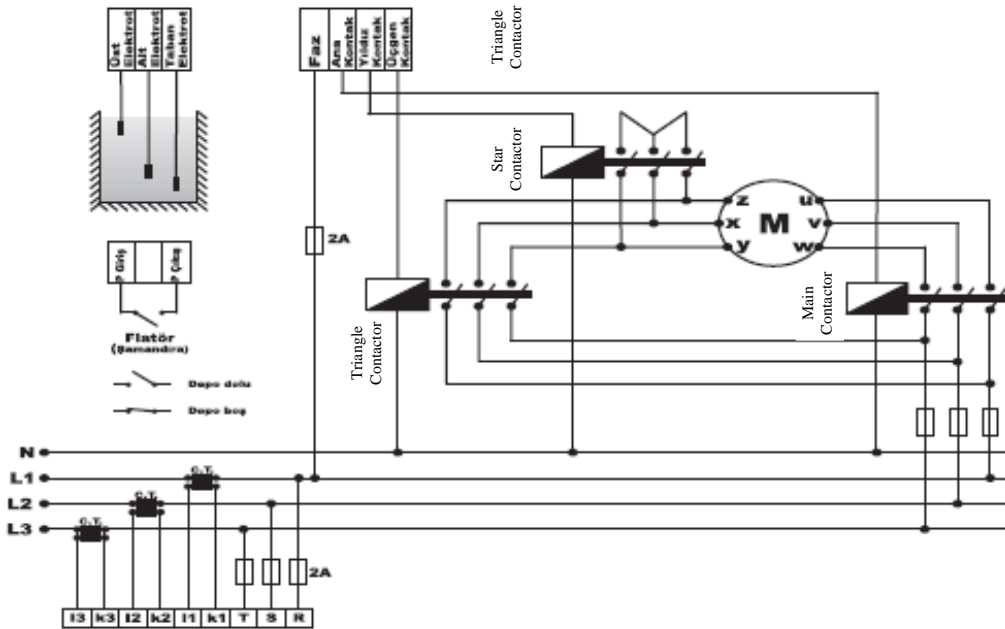
TURKISH MENU

NO NEUTRAL

Ability to operate without electrode

- ✳ [4 x 20 LCD display
- ✳ Easy-to-use menu
- ✳ Ability to adjust high or low cosine set
- ✳ Ability to adjust high or low current
- ✳ Ability to adjust high or low voltage and asymmetric voltage
- ✳ Ability to adjust asymmetric voltage
- ✳ Ability to adjust the upper electrode waiting time
- ✳ Ability to adjust liquid sensitivity
- ✳ Ability to store the error records
- ✳ Star-Triangle contactor terminals
- ✳ Flasher mode
- ✳ Extends the life of electrodes
- ✳ Start / Stop memory
- ✳ Informs the motor maintenance time
- ✳ Manual automatic and semi-automatic resetting

## 1-Connection Diagram



## 2-Start-up of the Device

Before making the connections of the device, please read the warnings section. Make the connections of the device according to the diagram. Make sure that the phases and the transformer terminals of them are connected to the right positions in order to ensure the device to measure the cosine value properly. Then energize the device. The device firstly controls the system status. It checks the phase order, voltage values and the status of the well and the tank. Then it stands by until the first launch time. Enter into the menu while the device is counting this time. Change the values suitable for your system (operating current and voltage range of the pump, liquid conductivity, etc.) on the related program. On TDK-04 model, enter into the menu and adjust the current transformer value via the parameter of **P.0 Current Transformer Value**. After you made the required adjustments, you can exit from the menu by pressing reset button. Press the start button.

If the device is on the start position, the voltage value is normal, the phase order is correct and the well is full or empty, the device operates the pump by firstly energizing the star contactor and then the main contactor. The star contactor counts for the adjusted time, and the device deenergizes it. 100 msec. later, the triangle contactor is energized. By this way, its position is protected.

When a **high or low voltage error** occurs on any of the phases, the device waits for 2-3 seconds and stops the pump. While the voltage values decreases from high voltage level to normal level, it switches to high voltage hysteresis area. When the device is in high voltage hysteresis area, it gives the information of **High Voltage Hysteresis**. The device cuts the energy. The voltage values should decrease a bit more. In order to provide the device to energize the system, press the reset button and see the information of "**System has been reset**". While the voltage values increases from low level to normal level, the device switches to low voltage hysteresis area. When the device is in low voltage hysteresis area, it gives the information of **Low Voltage Hysteresis**. The device cuts the energy. The voltage values should decrease a bit more. In order to provide the device to energize the system, press the reset button and see the information of "**System has been reset**". When the voltage values reach to normal level, the device waits for 2-3 seconds and automatically operates the pump again.

If a high current error occurs on any of the phases, the device waits for the value of **P.5 High Current Error Time** and stops the pump. If a low current error occurs on any of the phases, the device waits for the value of **P.6 Low Current Error Time** and stops the pump. If any value adjusted via the parameter of **P.7 High Voltage Reset Time**, the device counts this time and operates the pump (automatic reset). Otherwise, if the **P.7** parameter is on "**OFF**" position, the user should operate the pump by pressing the reset button (manual reset).

If a **phase order error** occurs, please check by using the measuring instrument whether the phases are properly connected to the device or not. If three phases transfer energy to the device, cut the energy of the device and correct the phase order. At the same time, correct the current transformer terminals and energize the device. When a phase order error is seen on the screen, press reset button.

**P.29 SHOW THE ERRORS:** The device stores the errors of high voltage (**High\_V**), low voltage (**Low\_V**), high current (**High\_C**), low current (**Low\_C**), voltage asymmetry (**Asymmetry Error**) and cosine (**Cosine Error**) in number. Error records are only deleted via **P.30**.

**P.30 DELETE ERRORS?** : It deletes the error records. In order to delete the errors, switch the parameter value from off to on position and press the menu button. The error history is deleted.

**Value range** = on-off, **Default value** = off

**P.31 VOLTAGE AUTO RESET** : It is used to reset the system automatically or manually, when the voltage values return to normal levels after a high voltage, low voltage or asymmetry errors has occurred. Voltage auto reset function is on position. In other saying, the device resets the pump automatically after the voltage error is corrected. If you want to reset manually after the voltage error, switch the parameter value from on to off position and press the menu button.

**Value range** = on-off, **Default value** = on

**P.32 Motor Maintenance Time:** The motor and pumps should be maintained after they have been used for a definite period. During these maintenance works, it will be beneficial to maintain the well etc. This parameter enables the technical service to adjust a value for motor and well maintenance. After the value is adjusted, sometimes the instruction of **Motor Operating Time**= is displayed on the lower line of the screen and here, the operating time of the motor informed in hours. When the operating time is up, the warning of **MOTOR MAINTENANCE TIME** is displayed on the lower line of the screen. When this warning is displayed, the motor and well should be maintained. In order to set this time, consult to technical service.

**Value range** = off - 5000 hours, **Default value** = off

**P.33 Reset Motor Maintenance Time:** It is used to reset the motor maintenance time after the maintenance works of motor and well are carried out. In order to reset this time, consult to technical service.

**Value range** = on-off, **Default value** = off

## 6-Information Messages:

<b>High Voltage Error.....:</b>	It shows that the voltage is above the adjusted high voltage value.
<b>Low Voltage Error.....:</b>	It shows that the voltage is below the adjusted low voltage value.
<b>High Voltage Hysteresis.....:</b>	It shows that the voltage is within the high voltage hysteresis area.
<b>Low Voltage Hysteresis.....:</b>	It shows that the voltage is within the low voltage hysteresis area.
<b>High Current Error.....:</b>	It shows that the current is above the adjusted high voltage value.
<b>Low Current Error.....:</b>	It shows that the current is below the adjusted low voltage value.
<b>Asymmetry Error.....:</b>	It shows that the voltage asymmetry is above the adjusted asymmetry value.
<b>Phase Order is Wrong.....:</b>	It shows that the phases are connected in wrong order.
<b>Well is Empty.....:</b>	It shows that the liquid level within the well is below the lower electrode.
<b>Medium Level.....:</b>	It shows that the liquid level within the well is between the upper and lower electrodes.
<b>Lower Electrode Error.....:</b>	It shows that the connections of the lower electrode are wrong.
<b>Tank is Full.....:</b>	It shows that the tank is full of water.
<b>Stop Position.....:</b>	It shows that the device is on stop position.
<b>Flasher On.....min.....:</b>	It counts the operating time when the device is on flasher mode.
<b>Flasher Off.....min.....:</b>	It counts the stand-by time when the device is on flasher mode.
<b>Motor is on Star Contac.....:</b>	It shows that the pump operates on star contactor.
<b>Motor is on Triangle Contactor..:</b>	It shows that the pump operates on triangle contactor.
<b>MOTOR MAINTENANCE.....:</b>	It informs you to call the technic service in order to carry out the maintenance of motor and well.
<b>Motor Operating Time.....:</b>	It shows how many hours the motor has been operating.
<b>Upper Electrode Waiting Time...:</b>	It shows that the pump is on the upper electrode waiting time.
<b>System has been Reset.....:</b>	The device resets itself manually or automatically in order to detect the system error has been corrected and operates the pump.
<b>No Water in the Well.....:</b>	It shows that the water has run out in cosine usage and the device does not operate the pump.

**P.18 Flasher Mode:** It informs whether the pump and motor operates in flasher mode or not. In order to provide them to operate in flasher mode, this value should be on “ON” position. Otherwise they do not operate in flasher mode.

**Value range** = on - off **Default value** = off

**P.19 Flasher On Time:** It adjusts the operating time of the device when it is on flasher mode. The operating time is counted down on the lower line.

**Value range** = off-850 min., **Default value** = 6 min.

**P.20 Flasher On Time:** It adjusts the operating time of the device when it is on flasher mode. The operating time is counted down on the lower line.

**Value range** = off-850 min., **Default value** = 6 min

**P.21 Start/Stop Memory:** It adjust whether the device will be launched on start or stop position when the device is energized after its energy has been cut off. When the device is energized again, it launches in the last operating position (start or stop). If you want the device to launch in start position, set the value to **on** and switch the device to start position while it is operating. When the devices is energized again, it launches on start position and operates the pump without waiting user order. Otherwise, the device launches on stop position.

**Value range** = on - off, **Default value** = off

**P.22 Restore Factory Settings:** It is used to delete the adjustments you made in the menu and restore to factory settings. Switch the “Off” position to “On” position by using the up and down buttons and press the menu button. The device restores factory settings.

**Value range** = on - off, **Default value** = off

**P.23 Password Value:** A password is created for the menu. When the password value is on “off” position, password is not requested when you enter in the menu. If you adjust the value between 1 and 253 and exit from the menu by saving, the value you set is used as the menu password from then on. When you want to enter into the menu, the device will request you to enter password. Until you enter the right password, it will repeat this. If you forget the password, you can enter 23 as constant value.

**Value range** = off - 253, **Default value** = off

**P.24 Low Cosine Set:** It is used to adjust the low cosine (Cos<sub>o</sub>) value which will provide the device to detect that the well is empty (the pump operates without water) in situations where electrodes are not used. When the pump operates, cosine values of the phases are displayed on the lower line. If the cosine value is below the adjusted low cosine value, the device stops the pump and displays the warning of “No Water in the Well” on the screen.

**Value range** = off - 0100 - 0999, **Default value** = off

**P.25 Low Cosine - Reoperation:** It is used to adjust the time required for filling of water in the well again after the device has stopped the pump due to low cosine. This value may vary according to the season, region and dimensions of the well.

**Value range** = 0-850 min., **Default value** = 1 min

**P. 26 High Cosine Set:** It is used to adjust the high cosine (Cos<sub>h</sub>) value which will provide the device to detect that the well is empty (the pump operates without water) in situations where electrodes are not used. When the pump operates, cosine values of the phases are displayed on the lower line. If the cosine value is above the adjusted high cosine value, the device stops the pump and displays the warning of “No Water in the Well” on the screen.

**Value range** = off - 0100 - 0999, **Default value** = off

**P.27 High Cosine - Reoperation:** It is used to adjust the time required for filling of water in the well again after the device has stopped the pump due to high cosine. This value may vary according to the season, region and dimensions of the well.

**Value range** = 0-850 min., **Default value** = 1 min

**Example:** Assume that the cosine values of the pump under rated current are R: 0.98, S: 0.97 and T: 0.98, and we adjust the cosine value as 0900 (0.90) in P.24. The cosine value decreases as of the moment when the pump operates without water and the pump is stopped immediately when it drops below the low cosine value.

**Note: If you change the water pressure via the valve while you are irrigating, the cosine value also changes. Therefore, adjust the cosine values by considering the pressure level you used during irrigation. Otherwise, the device gives the error of “no water in the well”.**

**P.28 Electrode Set:** It shows the conductivity of the liquid. The conductivity of the liquid is variable. If the read electrode value is below the adjusted electrode value, the electrode contacts with water. If it is above the adjusted electrode value, it does not contact with water.

**Example:** When there is water in the well (when the water contacts with electrodes), enter in the parameter of **P.16 Electrode Reading** on the menu. Here, you can see the lower and upper millivolt values. Generally, the waters with high conductivity are under 100 mV. The waters with low conductivity are above 1000 mV. Assume that Upper Electrode = 200 mV and Lower Electrode = 212 mV. 1 - 2 minutes later, see that average values of the electrodes are as these values. Then set the electrode value to about 1000 mV - 1500 mV on **P.28**. Since the well is wet, values above 2000 mV - 3000 mV may be read on the wells of conductive water, although the electrode does not contact with water.

**Value range** = 0 - 4900 mV., **Default value** = 3000 mV

If **asymmetry error** occurs, the device waits for 2-3 seconds and stops the pump. When the asymmetry ratio on the phases returns to normal level, the device waits for 2-3 seconds and operates the pump automatically.

If the warning of “**well is empty**” is displayed on the screen when electrodes are in use, electrodes do not contact with water and the pump is stopped. This warning is displayed until the well is filled with water. After the well is filled with water, the device counts for **P.14 Upper Electrode Waiting Time** and the statement of “**upper electrode waiting time**” is displayed on the screen. At the end of this time, it operates the pump.

If the warning of “**Lower Electrode Error**” is displayed on the screen when electrodes are in use, it is understood that the upper electrode contacts with water while the lower electrode does not. Check the connections of lower electrode. After correcting the error, press reset button.

If the cosine value is above **P.26 High Cosine Value** and the warning of “**no water in the well**” is displayed on the screen, it can be understood that the pump operates without water and the device stops the pump immediately. The device waits for **P.27 High Cosine - Reoperation** time until the well is filled with water and operates the pump at the end of this time. If the cosine value is below **P.24 Low Cosine Value** and the warning of “**no water in the well**” is displayed on the screen, it can be understood that the pump operates without water and the device stops the pump immediately. The device waits for **P.25 Low Cosine - Reoperation** time until the well is filled with water and operates the pump at the end of this time. If the difference between the cosine values displayed on the screen is too much, the transformer terminals are not on the correct order. In other saying, the current transformer terminals of L1 phase should be connected to k1 - l1 inputs. **While using cosine, disconnect the electrode connections.**

**Note:** Under normal conditions, the current and cosine values of submersible pump motors drop down. However, the current and cosine values of some of the submersible pump motors increase when the water runs out. Consider this when adjusting the values.

The pump is stopped when the **tank is full of water**. When the tank is empty, it is operated automatically. Floater or buoy may be used in the tank. If you do not use a tank, short out the tank terminals.

**Note:** When the energy of the device is cut off after an error occurs on it and if the error continues to be displayed on the screen, press the reset button in order to operate the pump.

**Resetting the System Automatically:** If you want the device to reset itself (to operate the pump) automatically after any high or low current errors, a time value should be adjusted on **P.7 High Current Auto Reset** parameter for high current and **P.8 Low Current Auto Reset** parameter for low voltage. When values are adjusted on these parameters, the device counts these time periods and operates the pump automatically.

**Resetting the System Automatically:** When any current error occurs on the device, you can reset it by pressing the reset button.

If you do not press any button for 5 seconds, the light of the LCD screen will turn off automatically. When you press the up or down button, it turns on again.

**Flasher Mode:** Under normal conditions, the pump operates for a definite time (Flasher On Time) instead of operating constantly. After the adjusted time is up, the motor stands by for a definite time (Flasher Off Time). At the end of this time, the Flasher switches to “On” position. This cycle continues constantly. In case of energy cuts, the cycle continues from the latest position. On the lower line of the screen, its mode and the remaining time values are displayed.

**Example:** Assume that the pump operates for 1 hour and stands by for 3 hours.

Switch the menu to **P.18 Flasher Mode** by pressing the menu button and then the up button. Press the menu button again and switch the value to “**on**” position by pressing the up or down button. Press the menu button again and switch to **P.19 Flasher On Time**. Press the menu button again and adjust the time value as 60 min (1 hour = 60 min.) by using up or down button. Press the menu button again and switch to **P.20 Flasher Off Time**. Press the menu button again and adjust the time value as 180 min. (3 hours = 180 min.) by using up or down button. Complete the adjustment by pressing the menu button again. Exit from the menu by pressing reset button.

**Adjusting the Asymmetry Ratio:** The device calculates this ratio as the ratio of the difference between the highest and lowest phase values (among three phases) to the highest phase value. Thanks to this function, you can determine the return voltage arising from the energy cut-offs on the phases and prevent the motor from getting harm. While the pump is operating, disconnect one of the phases and measure the values of the other phases by using the measuring instrument. Calculate the voltage difference between the highest and lowest phase values and divide this value to the highest phase value.

**Example:** Assume that RS= 435 V, ST = 400 V and TR = 360 V. The return voltage obtained by cutting the energy of phase T is calculated as;

Difference:  $435V - 360V = 75V$ . From here;

**Asymmetry Ratio** = Difference / Highest Voltage =  $75V / 435V = 0,17$ .

Asymmetry rate needs to be less than 17% in order to enable the device detect the return voltage. The asymmetry rate should be <16%. We press the menu button and then find **P.10 Asymmetry Set (V)** by pressing the up button. We press the menu button again and set the value as 16 by using the up or down buttons. We save the value by pressing the menu button again. We exit the menu by pressing the reset button.

### 3- Use of Front Panel of the Device

- 1= **Start button** shifts the device to start position and operates the pump.
- 2=**Stop button** shifts the device to stop position and stops the pump.
- 3=**Menu button** is used to enter the menu and save the value changes.
- 4=**Down button** is used to navigate the menus and for value changes.
- 5=**Reset button** is used to exit the menu and operate the pumps upon errors.
- 6=**Up button** is used to navigate the menus and for value changes.
- 7= **LCD display** gives information about the status of the device and the system.



### 4- Using the Menu:

Menu button is pressed to **change a value in the menu**. We press the up and down buttons to find the program that we want to change. We press the menu button when we find the program. We use up and down buttons to set the values we want. After setting the value, we press the menu button again. In this way the value change is saved and the system exits the program. Pressing the reset button once is enough to **exit the menu**. If you wait without pressing any button in the menu or program, the device will automatically exit the menu after about 15 sec.

You need to press the menu button singly to **navigate the menu and see the values**. You see that you are advancing in the menu when you press the menu button singly after you enter the menu. You can make value change in this way too.

### 5- Menu of the Device:

**P.0 Current Trans Value:** It determines the current transformer value in the model TDK-04. Here you can enter the current transformer value by advancing from menu to the program.

**Value range = 5/5A-5000/5A, Default value = 5/5A**

**P.1 High Voltage Set:** It determines the upper operating voltage of the pump or motor. If any phase goes over the adjusted voltage value, high voltage error occurs and the device stops the pump. When the voltage goes below the adjusted voltage value by 5V, the device operates the pump again.

**Value range = 390V-500V, Default value = 430V**

**P.2 Low Voltage Set:** It determines the lower operating voltage of the pump or motor. If any phase goes below the adjusted voltage value, low voltage error occurs and the device stops the pump. When the voltage goes over the adjusted voltage value by 5V, the device operates the pump again.

**Value range = 260V-370V, Default value = 300V**

**P.3 High Current Set:** It determines the upper operating current (**THERMIC**). If the current of any phase goes below the adjusted current value, low current error occurs and the device stops the pump.

**Value range = 0-120A (TDK-01), 0-300A (TDK-02) Default value = 0A**

**P.4 Low Current Set:** It determines the lower operating current (**THERMIC**). If the current of any phase goes over the adjusted current value, high current error occurs and the device stops the pump.

**Value range = 0-120A (TDK-01), 0-300A (TDK-02) Default value = 0A**

**P.5 High Current Error Time:** It determines the delay time to stop the pump or motor when high current error occurs on the pump or motor. If the current of any phase goes over the adjusted current value, the device counts this time and then stops the motor and pump.

**Value range = 0-850sec, Default value = 2A**

**P.6 Low Current Error Time:** It determines the delay time to stop the pump or motor when low current error occurs on the pump or motor. If the current of any phase goes below the adjusted current value, the device counts this time and then stops the motor and pump.

**Value range = 0-850sec, Default value = 2A**

**P.7 Load Current Auto Reset:** When error occurs on the pump or motor due to high current, it is stopped by the device. It determines whether the device is set automatically or manually to operate again. If the value is left **off**, the user needs to reset the pump stopped due to high current error by pressing the reset button. If the time value is entered, the pump stopped stands by for the adjusted time period and then operates again automatically.

**Value range = off-850sec, Default value = off**

**P.8 Low Current Auto Reset:** When low current error occurs on the pump or motor due to low current, it is stopped by the device. It determines whether the device is set automatically or manually to operate again. If the value is left **off**, the user needs to reset the pump stopped due to low current error by pressing the reset button. If the time value is entered, the pump stopped stands by for the adjusted time period and then operates again automatically.

**Value range = off-850sec, Default value = off**

**P.9 Auto Recount:** It determines how many times the device will operate again automatically (auto reset) after current error occurs on the pump. It performs auto resets as much as the number set for the parameter and the device switches to manual reset mode for the subsequent current errors. This menu is valid when a time value is entered in P.7 and P.8.

**Example:** Assume that P.7 = 3 sec and P.9 = 2

The pump is stopped when high current error occurs on it. The device is operated again after 3 sec. (P.7). If high current error occurs after a while again, this time the device does not operate the pump. The user needs to correct any error in the system and operate the device by pressing the reset button.

**Value range = 1-200 sec, Default value = off**

**P.10 Asymmetry Set (V):** It determines the ratio of the voltage difference between the phases having the lowest and highest voltage values to the highest phase. The device stops the pump in case of any problems due to the return voltage following voltage imbalance or phase interruption. The return voltage changes according to the power and speed of the pump.

**Value range = 0-200 sec, Default value = 11**

**P.11 Demurrage Multiplier:** When the pump or the motor is energized, the device draws current a few times more than normal operating current during load start-up. It is called demurrage current. The device allows demurrage (starting) current as the given multiplier value and the demurrage time. When the current value exceeds the multiplier, the pump stops suddenly. The device obtains the demurrage current by multiplying the high current set value and the demurrage multiplier.

**Value range = 1-50, Default value = 3**

**P.12 Demurrage Time:** It determines the start-up (demurrage) time of the pump and the motor. The device allows the demurrage current during this time.

**Example:** Assume that P.3 = 15A, P.11 = 3 and P.12 = 5 sec.

**Demurrage current = P.3 x P.12 = 15 x 3 = 45A**

The device allows the flowing of current up to 45 A for 5 sec. during the start-up time of the pump.

**P.13 Start Waiting Time:** It determines the operation times of three-phase operating pumps in the star contactor. After the time is over, it prevents the star contactor output and switches to triangle contactor 100 msec later.

**Value range = 0-850msec, Default value = 10sec**

**P.14 S>T Switching Time:** The time period during when the device waits from leaving the star contactor to drawing the triangle contactor.

**Value range = 0-850msec, Default value = 100msec**

**P.15 Upper Electrode Waiting Time:** It determines the waiting time for the operation of the pump by the device when the liquid level in the well reaches the upper electrode. The instruction of **Upper Electrode Waiting Time=.....min** is displayed during this waiting time and it counts down from the given time. It is used for more efficient operation of the pump.

**Value range = 0-850min, Default value = 0min.**

**P.16 Electrode Reading:** It shows the liquid level in the well. If P.28 is lower than the Electrode Set value, it means that the liquid contacts with the electrode. The value of millivolt may change based on the conductivity of the liquid. If the millivolt values falls down instantly to 100 mV and increases to 4900 mV during Electrode Reading, it means that there is a high voltage in the water. Grounding of the pump casing may be required.

**P.17 Launch Time:** It determines the time of delaying the operation of the pump in order to protect the pump from the voltage fluctuations occurring due to electric cut-outs.

**Value range = 0-850sec, Default value = 4 sec**

