PENTAIR

# DYNAMIC TORQUE CONTROLLER

# INSTALLATION AND OPERATION MANUAL

**pentair.com**

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# SAFETY INSTRUCTIONS

**SAVE THESE INSTRUCTIONS**: This manual contains important instructions that should be followed during installation, operation, and maintenance of the product. Carefully read and follow all safety instructions in this manual.

#### IMPORTANT SAFETY TERMINOLOGY

**⚠ DANGER** indicates a hazard which, if not avoided, *will* result in death or serious injury.

**⚠ WARNING** indicates a hazard which, if not avoided, *can* result in death or serious injury.

**⚠ CAUTION** indicates a hazard which, if not avoided, *can* or *may* result in minor or moderate injury.

**NOTE** addresses practices not related to personal injury.

#### CALIFORNIA PROPOSITION 65 WARNING

**⚠ WARNING** This product and related accessories contain chemicals known to the State of California to cause cancer, birth defects or other reproductive harm.

# INTRODUCTION

This guide provides information on how Pentair® Dynamic Torque Controller™ module is implemented at each site.

**ABOUT THE DYNAMIC TORQUE CONTROLLER**

The Dynamic Torque Controller is a low voltage electric pump management system. Its modularity can be easily extended, making it a versatile product suitable for numerous applications.

A key benefit of the Dynamic Torque Controller is the ability to monitor the performance of a motor in real-time, detecting and preventing clogging of the impeller. This customizable application is easily set up, with as few as three parameters. The device also contains full thermal overload and advanced motor protection to help ensure safe & efficient operation of your equipment.

By providing real-time power monitoring, the Dynamic Torque Controller offers powerful diagnostics. Performance characteristics for the motor are captured to enable the Dynamic Torque Controller to bring machine learning into its anti-clogging capabilities.

**APPLICATION OF THE PRODUCT**

The Dynamic Torque Controller can be installed on a variety of different three phase applications, many of which are listed below. Prior to implementation, it is always best that the user first get confirmation and guidelines from the manufacturer of the rotating equipment for reverse operation. Refer to compatible pump model recommendations. The implementation process is carried out in four steps: Survey, Installation, Pump Check/Cleaning and Start Up. These final three stages can be carried out easily in one day or can be spaced out if required without affecting energy pumping performance.

**PUMPS: WET WELL SUBMERSIBLE AND DRY PIT**

The Dynamic Torque Controller works well in centrifugal submersible and dry-pit pump applications. One Dynamic Torque Controller is required per pump and all configurations of pumps and pump arrangements can be accommodated. With it's monitoring function, the Dynamic Torque Controller can keep pumps clean even when running at slow speeds. The ability to map multiple torque profiles allows the Dynamic Torque Controller to compensate for torque variances when multiple pumps utilize a common discharge header.

**SOFTWARE APPLICATIONS / APPS**

The Dynamic Torque Controller can be configured with several applications if required these are detailed below.

**ANTI-CLOGGING**

The Dynamic Torque Controller has been designed from the ground up specifically for anti-clogging. The Dynamic Torque Controller has integral software which monitors the real time power characteristics of the pump and compare these to the characteristics displayed by the pump when it has been lifted and cleaned during the commissioning process. By detecting any divergences from this "clean profile" the Dynamic Torque Controller knows when it has to perform a clean cycle in order to keep the pump rag free.

The Dynamic Torque Controller clean cycle prevents blockages in two main ways. The first method of prevention is recognizing in real-time changes in the power signature and when to stop and reverse the pump. This momentary reversal allows any rags clinging to the impeller to be dislodged and passed in suspended flow forward through the system. The key benefit of the Dynamic Torque Controller is the real-time detection of when rags are impeding the impeller. Other methods of anti-clogging use timed reversal which purely attempts to guess when the impeller is being impeded. Quite often this technique leads to the pump being reversed when the impeller is already over-whelmed with rags. In this instance, reversal can actually lead to all the rags being knitted together into a rag ball and flung back into the well, only to be flushed through the system during a storm event, leading to severe clogging of the sewer pipe network. Real-time detection is essential for the reversal process to work. This is the unique benefit of the Dynamic Torque Controller.

The second way in which the Dynamic Torque Controller prevents blockages is to agitate and dislodge fat build up from the pump impeller. Since fat build up aids in rags collection the absence of this also prevents blockage.

As the impeller is running clean the load on the motor is less during normal operation, therefore the energy consumption of the pump is reduced by anything between a few percentage points (for a very lightly blocking pump) to well over 40% for a regularly blocking pump.

The anti-clogging functionality should also be used in applications where wet wells suffer from heavy rag inflow and need regular cleaning or vactoring. The anti-clogging functionality has shown to maintain cleaner wells as the rags are passed forward individually to the wastewater treatment plant or facility. This has reduced the requirement for manual well cleaning.

There are several ways that the Dynamic Torque Controller cleaning process can be triggered.

1. First, a clean can be triggered upon start up. This is where the Dynamic Torque Controller will perform a clean when the pump is asked to run, and is used where a pump has a tendency to retain a rag on the impellers when it has previously come to rest. The clean on start-up will then address this.
2. The second is with the Dynamic Torque Controller patented real time detection. This performs a clean when the Dynamic Torque Controller detects a blockage forming.
3. The third is via an external trigger. This allows a PLC, low flow or push button to toggle a clean.
4. The fourth is a timed clean operation. This performs a clean every user defined time for example every 20 minutes or every few hours of running. This method is not advised to be used for the reasons referred to earlier in this section.
5. The final is a set-point on the analog input. This measures the analogue input and if the level drops below the set-point a clean can be triggered. This is used where a flow instrument is wired in and the flow drops of due to a blockage.

**MOTOR PROTECTION**

The Dynamic Torque Controller has sophisticated advanced motor protection included. The following is protection is available:

- Overload
- Phase Loss
- Current Imbalance
- Overcurrent
- Undercurrent
- Frequency out of range

## PACKAGE CONTENTS

The Dynamic Torque Control Kit comes containing all the parts and a number of components required to assist with installing the unit.

**DYNAMIC TORQUE CONTROL KIT**

| CATALOG | ENGINEERING # | DESCRIPTION |
|---|---|---|
| DTC-25AK | 604411025K | 25A Dynamic Torque Control Kit |
| DTC-50AK | 604411050K | 50A Dynamic Torque Control Kit |
| DTC-100AK | 604411100K | 100A Dynamic Torque Control Kit |
| DTC-200AK | 604411200K | 200A Dynamic Torque Control Kit |
| DTC-400AK | 604411400K | 400A Dynamic Torque Control Kit |
| DTC-600AK | 604411600K | 600A Dynamic Torque Control Kit |
| DTC-800AK | 604411800K | 800A Dynamic Torque Control Kit |

**KEYPAD**

- Allows interface with the Dynamic Torque Control Kit unit
- Useful Pump Data Displayed On Screen


## MODULES & CABLES:

**POWER MODULES**

- 3 x Current Sensors Supplied. Available In 7 sizes: 25A, 50A, 100A, 200A, 400A, 600A and 800A
- Color Coded For Easy Identification

**PC CONFIGURATION CABLE**

- Configuration cable required to connect Dynamic Torque Control module via the keypad to PC or laptop.

**KEYPAD CABLE**

- 2-meter Power/Data cable for the Dynamic Torque Control Kit to connect to the keypad

**ACCESSORIES KIT**

- 3 – Fuse Terminals with fuses for the voltage reference signal input
- A Metal Oxide Varistor to protect the Digital inputs from power surge
- Keypad mounting kit: screws, washers, etc, washers etc
- USB stick containing technical information, drawings, and software

# MANDATORY PRE-INSTALLATION CHECKS

Once the Site Survey Form (see below) is complete, it is imperative to also undertake additional checks prior to installation and through the commissioning phase.

These checks come in the form of one single document called the Dynamic Torque Control Kit Product Installation and Commissioning Procedure Guide (PICP Guide). This must be completed and signed off before proceeding through each next stage. The process you must follow, including detail of when signatures must be provided, is explained in the following diagram.

### SITE SURVEY FORM

Before any install or commissioning procedures are carried out it is necessary for a Site Survey Form to be completed. (It may be advisable to complete this form before any quotations are supplied to ensure that the Dynamic Torque Control Kit is suitable for the intended application). The Site Survey Form can be carried out by the customer if they have the sufficient in-house expertise, if not, it should be completed by a fully approved Dynamic Torque Control Kit install and commissioning engineer.

### PRE-INSTALLATION QUESTIONNAIRE

While some of Section A may appear to be re-affirming some of the details of the Site Survey Form, it contains additional important checks. It also captures all of the information in one single place so customer, installer, commissioner and Dynamic Torque Control Kit are all clear that the correct process has been followed.

Signatures must be provided on completion of Section A of the Site Survey Form as indicated.

### ADDITIONAL COMPONENTS

Some additional control components are required to integrate the Dynamic Torque Control Kit into a control panel if reverse operation is required.

### VFD

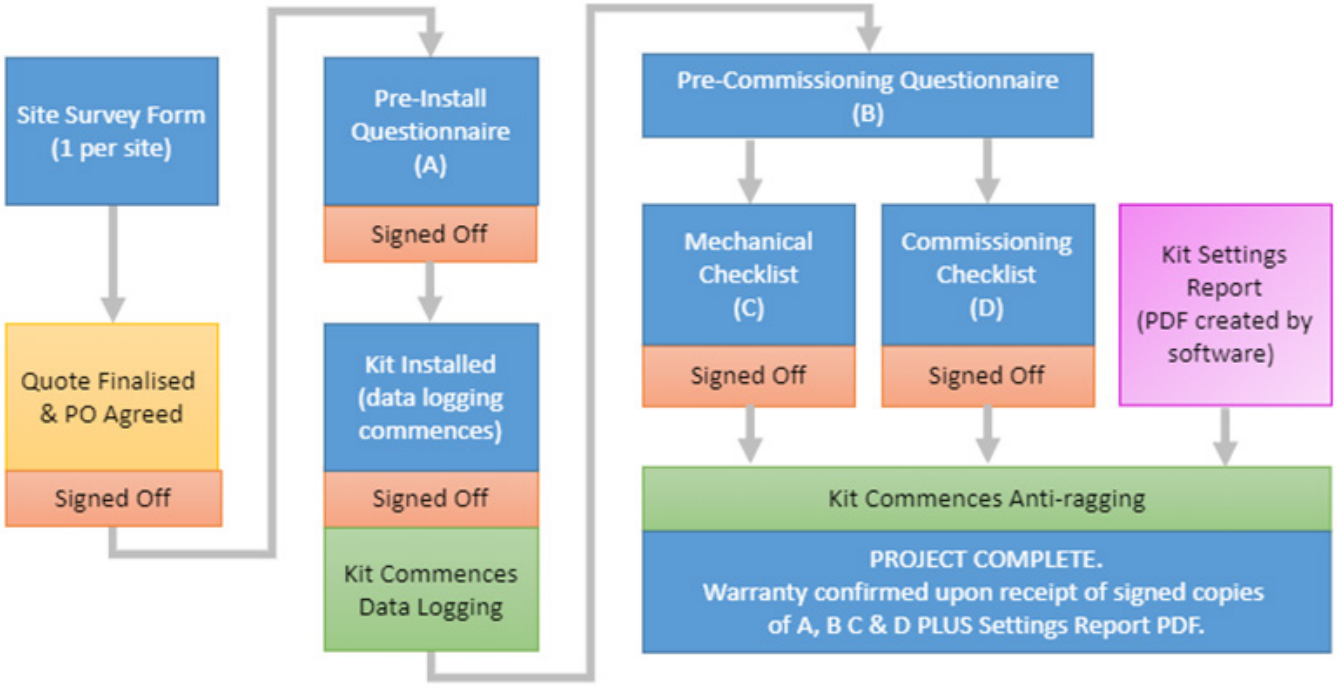
For a VFD installation a control wire (typically 16awg) is required. You may require an ice cube relay to change the voltage for the start signal.

### SOFT STARTER

For a soft start as well as the materials for VFD a forward and reverse contactor at a suitable rating for the motor is required.

### ACROSS THE LINE

For across the line a control wire (typically 16awg) is required. You may require an ice cube relay to change voltage for the start signal and you will also require a reverse contactor at a suitable rating for the motor.




**Pre Install and Pre-Commissioning Process**

This section will guides you through the installation steps for each starter type.

### MOUNTING

The Dynamic Torque Control Kit is TS35 Din rail mountable. The Power modules sit directly over the motor conductors. They typically sit above the contactor due to the small size. The power modules can be mounted up to 6 feet from the Dynamic Torque Control Kit.

### ENVIRONMENT

The Dynamic Torque Control Kit is IP21/NEMA 1 rated. It should therefore be enclosed inside an enclosure suitably rated to provide the following

- Ambient temperature: 14°F(-10°C)-122°F(50°C)
- Relative humidity: 95% non-condensing

### ELECTRICAL INSTALLATION

**⚠ WARNING** Warning all electrical installation must be installed by a suitably competent person

The Dynamic Torque Control Kit is supplied by either 110Vac – 230Vac supply. TThe device can take 110Vac-230Vac digital inputs which allows wiring without any intermediate relays. The device is also equipped with N/O and N/C volt free fault relays.

**⚠ CAUTION** **A surge arrestor/metal oxide varistor (MOV) must be used to protect the digital inputs from transient voltage spikes that can damage the inputs.**

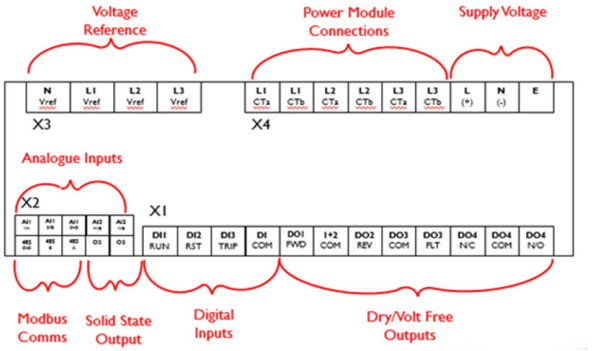
### INSTALLING ON DIFFERENT STARTERS

The information below walks through installing the Dynamic Torque Control Kit in different starter types.

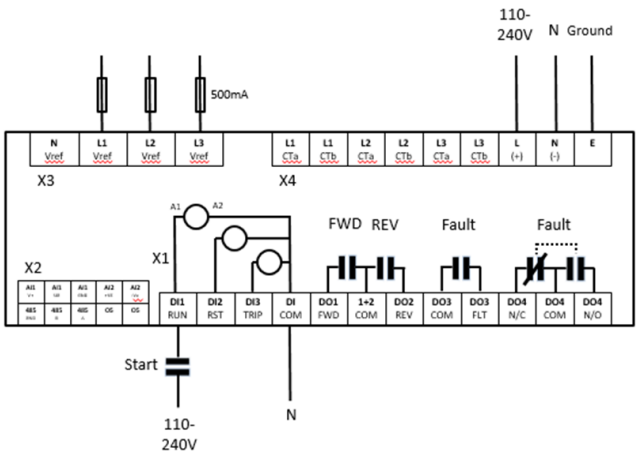
### ACROSS THE LINE/ DIRECT ON LINE

To install the Dynamic Torque Control Kit on "across the line starters" the existing line contactor needs to be identified.

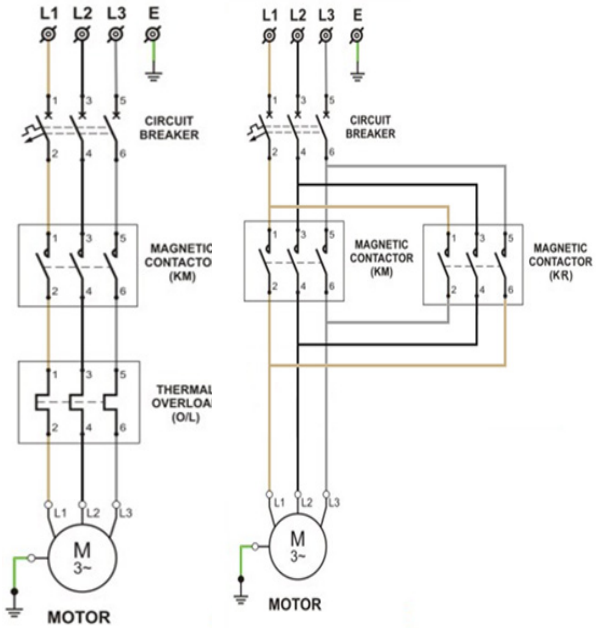
From here a reversing starter needs to be added. The motor thermal overload can be removed if desired. The control wires from the thermal overload's Normally Open and Normally Closed contacts can be wired into the Dynamic Torque Control Kit output 3 and 4 as Normally Open and Normally Closed fault dry contacts. Remove the control wires from A1 and A2 of the line contactor and feed these into Di1 and Dicom. Thus when the contactor was energized previously it will now start the Dynamic Torque Control Kit.

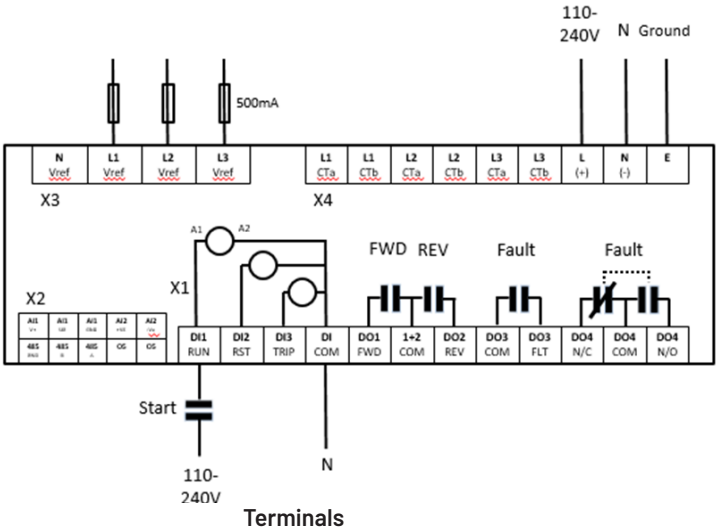



Terminals




Basic Connection Diagram

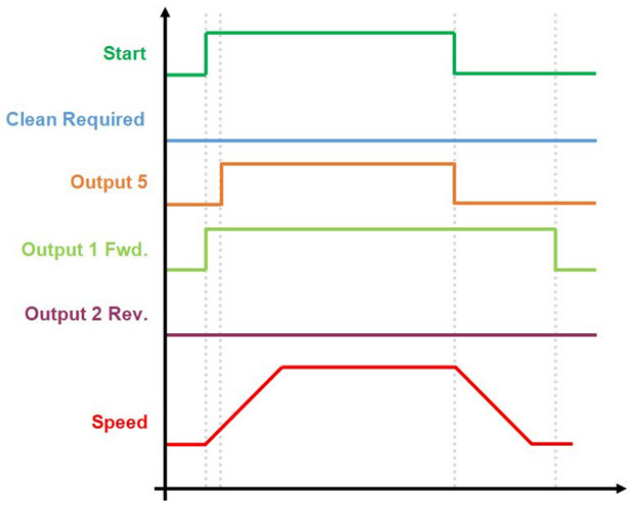




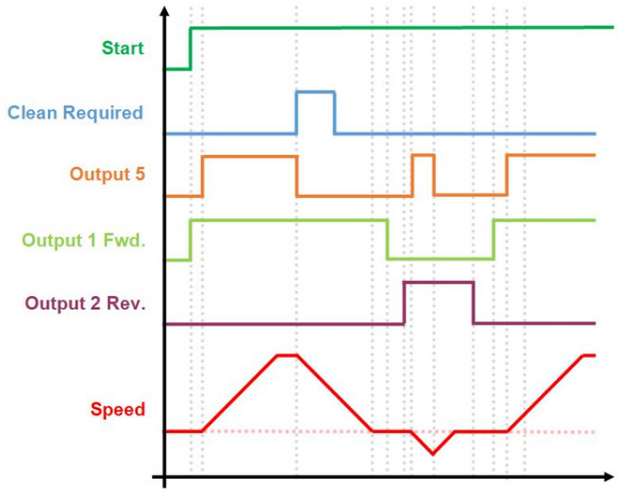

Terminals

**SOFT STARTER**

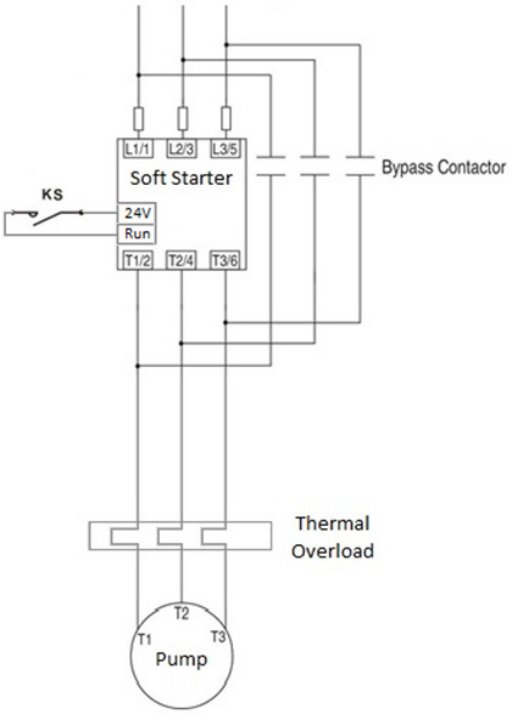
In a soft starter application, reversal of the pumps is done by switching the phases of the pump on the load side of the soft starter. The Dynamic Torque Control Kit controls both the soft start and the forward and reverse contactors. This allows a controlled ramp up and ramp down of the soft starter before changing phases. By adjusting the reverse time in the Dynamic Torque Control Kit, it dictates how far up the ramp the soft start gets in reverse thus limiting the speed. If the ramp was set at 10s and the reverse time in the Dynamic Torque Control Kit to 5s then the Soft starter would only get to 50% before ramping down to zero. The control timing for this is:



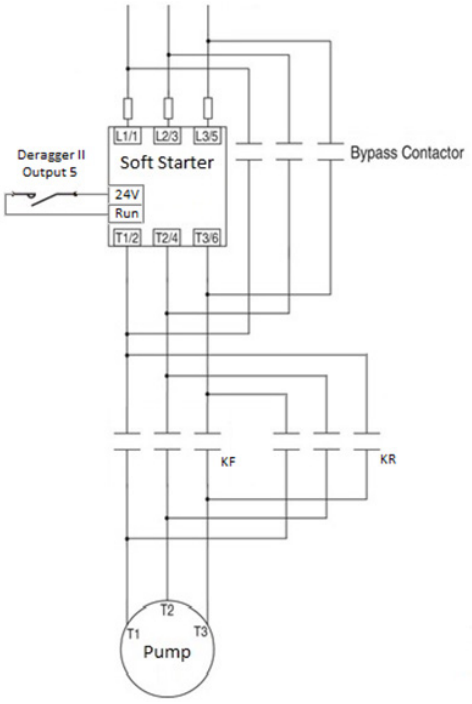

Pump Starting



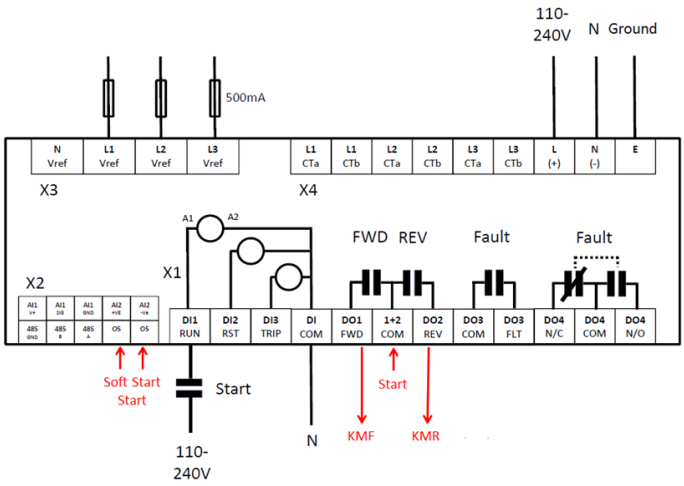

Clean Cycle



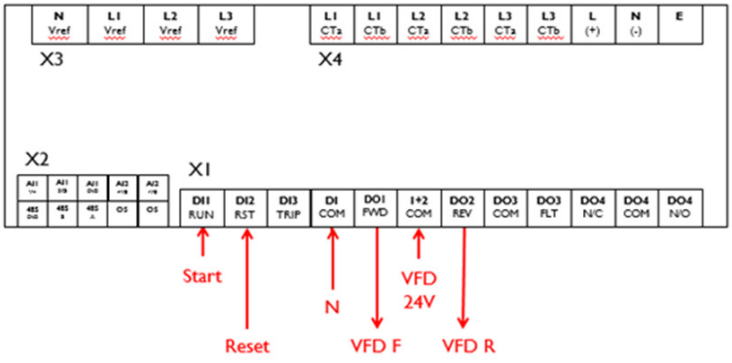

Typical Soft Starter Drawing




Reversing Soft Starter




Terminals – Soft Start




Terminals – VSD/VFD

**VARIABLE SPEED DRIVE / VARIABLE FREQUENCY DRIVE**

The integration of Dynamic Torque Control Kit on variable speed drives is in some ways simpler to the above example as the method of reversing is carried out in the existing VSD/VFD. This negates the need to change the power wiring and only minor modifications to the control wiring is required.

The Dynamic Torque Control Kit must take its voltage and energy measurements on the output of the VSD/VFD. The Dynamic Torque Control Kit is designed for use with the high frequency switching of the inverter and this does not affect operation.

# COMMISSIONING

**PUMP CHECK**

Before any commissioning can take place, the pump mechanics need to be checked as detailed below.

**PRE-COMMISSIONING QUESTIONNAIRE ON PUMP STATUS**

At the point of commissioning any Dynamic Torque Control Kit product, the Pre-Commissioning Questionnaire must be completed (Section B of the PICP Guide as shown below). This report needs to be based on the data available thus far, and therefore is ideally completed by the Pentair Rep. Following analysis of data gathered during the Dynamic Torque Control Kit's torque monitoring phase (i.e. after installation but before anti-clogging is enabled). If that is not possible, it is the responsibility of the installer to review the data on-site and ensure the below is adhered to.

**MECHANICAL CHECKLIST**

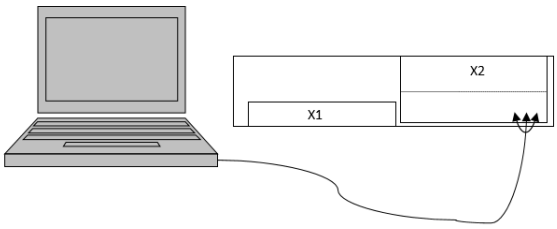
Also prior to commissioning the Dynamic Torque Control Kit, a mechanical check must be completed, and the following Mechanical Checklist completed and signed-off as detailed. This is Section C of the Dynamic Torque Control Kit Product Installation and Commissioning Procedure Guide (PICP Guide).

**⚠ CAUTION Ensure Section C is signed off as detailed before proceeding.**

**ESTABLISHING COMMUNICATIONS**

Connect a laptop or PC to the Dynamic Torque Control Kit via the configuration cable and open the configuration software by double clicking the icon.

Connect the cable as per the connection diagram below.



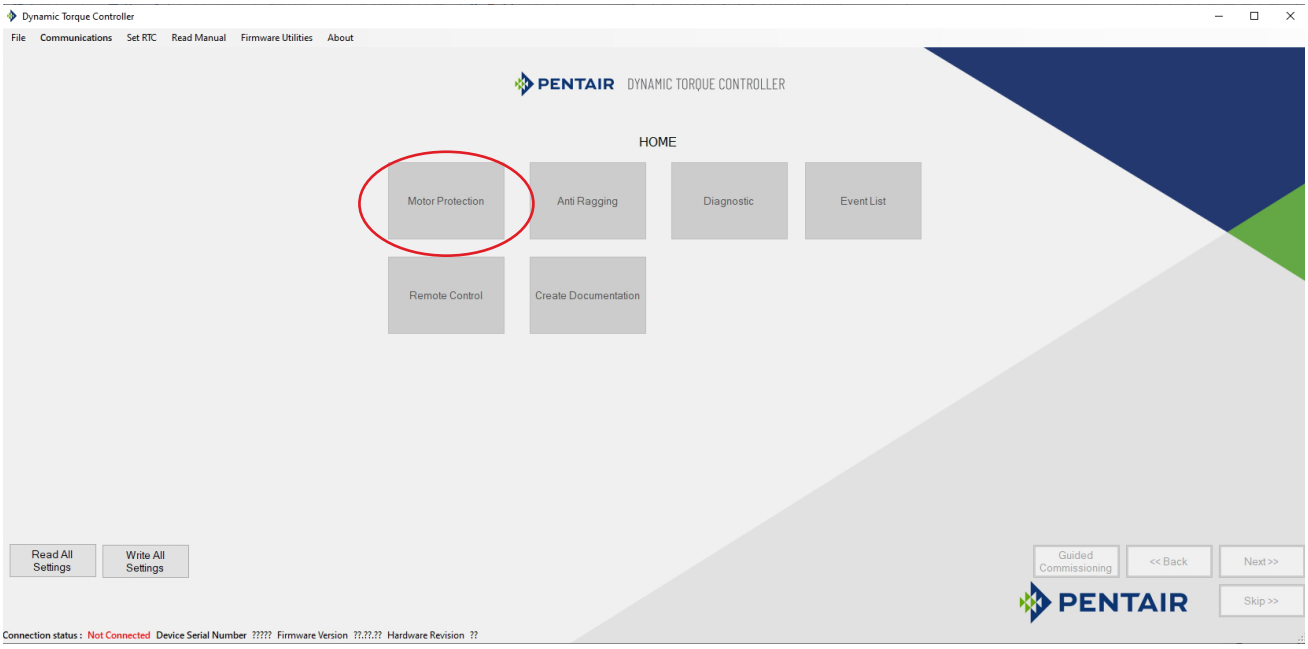

In the configuration software select communications -> PC Serial Connect. Enter your username and password provided by your Rep and then press connect.

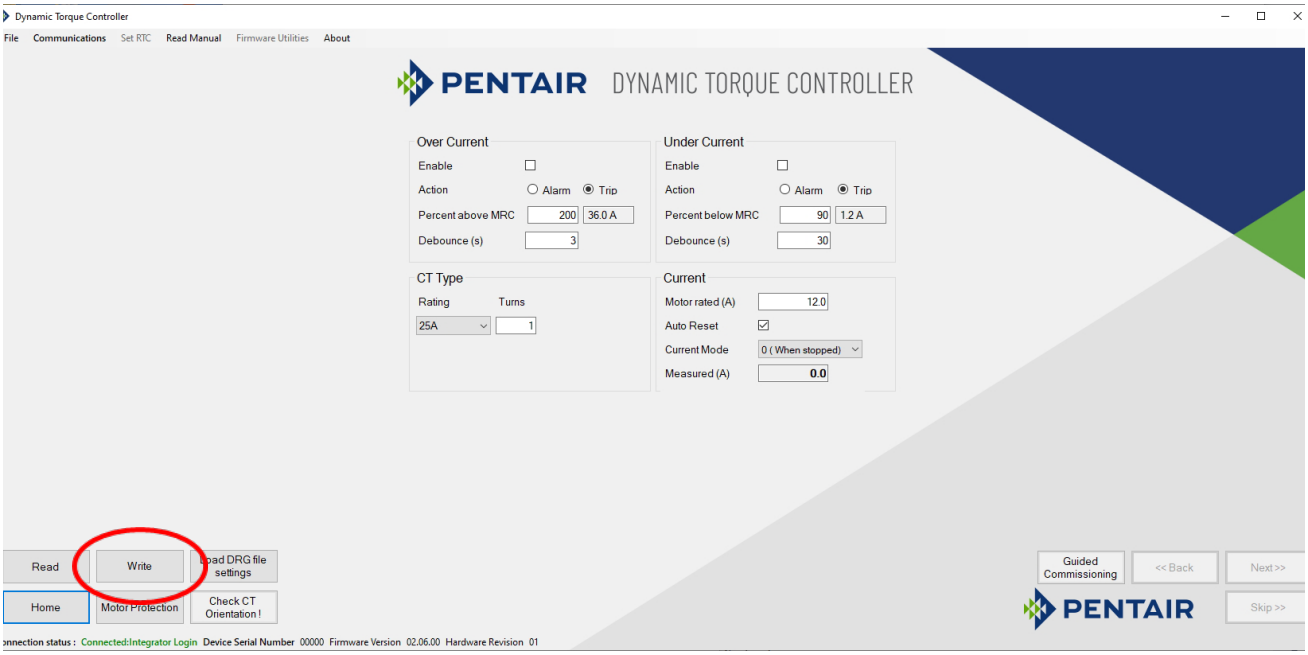
Once connected you are presented with the home screen shown below.

**SOFTWARE OVERVIEW – BEFORE THE MOTOR IS RUN**

**MOTOR PROTECTION**

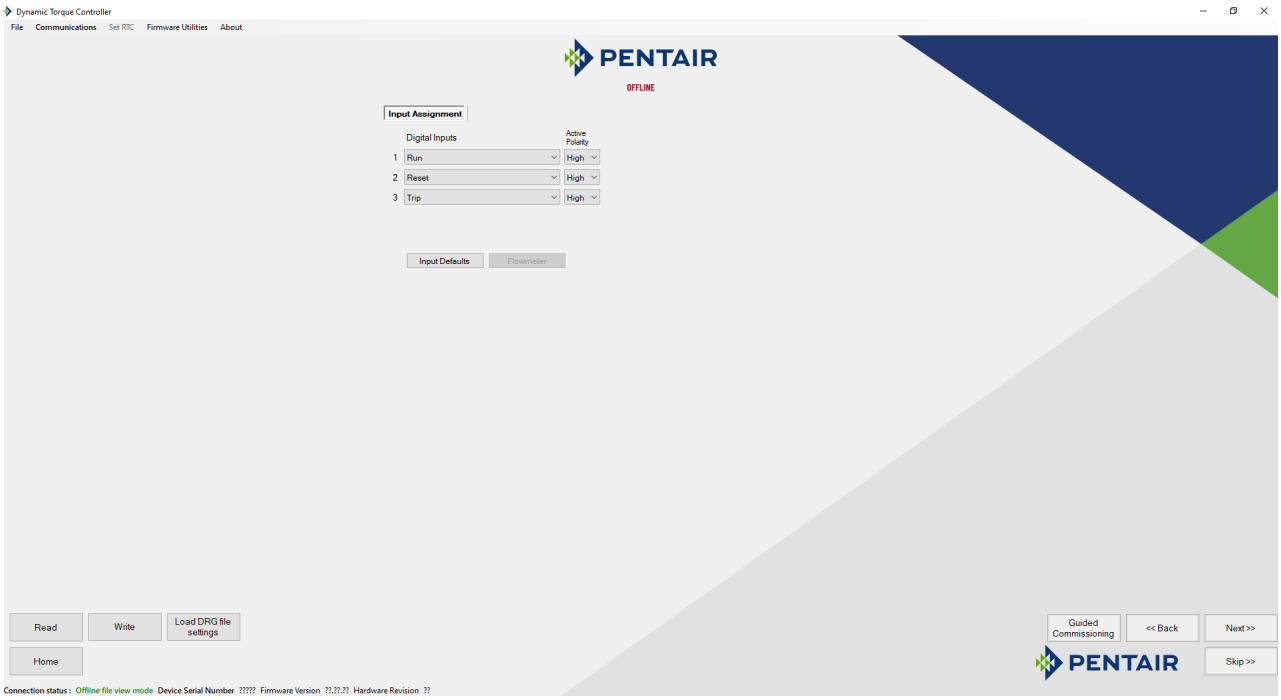
1. Before the Anti-Clogging function can be set up, the motor information as well as the inputs and outputs need to be set. To set the motor information, select Motor Protection here. When the next screen appears, select Energy.
2. Select the Energy Sensor type and Motor FLC on this screen..



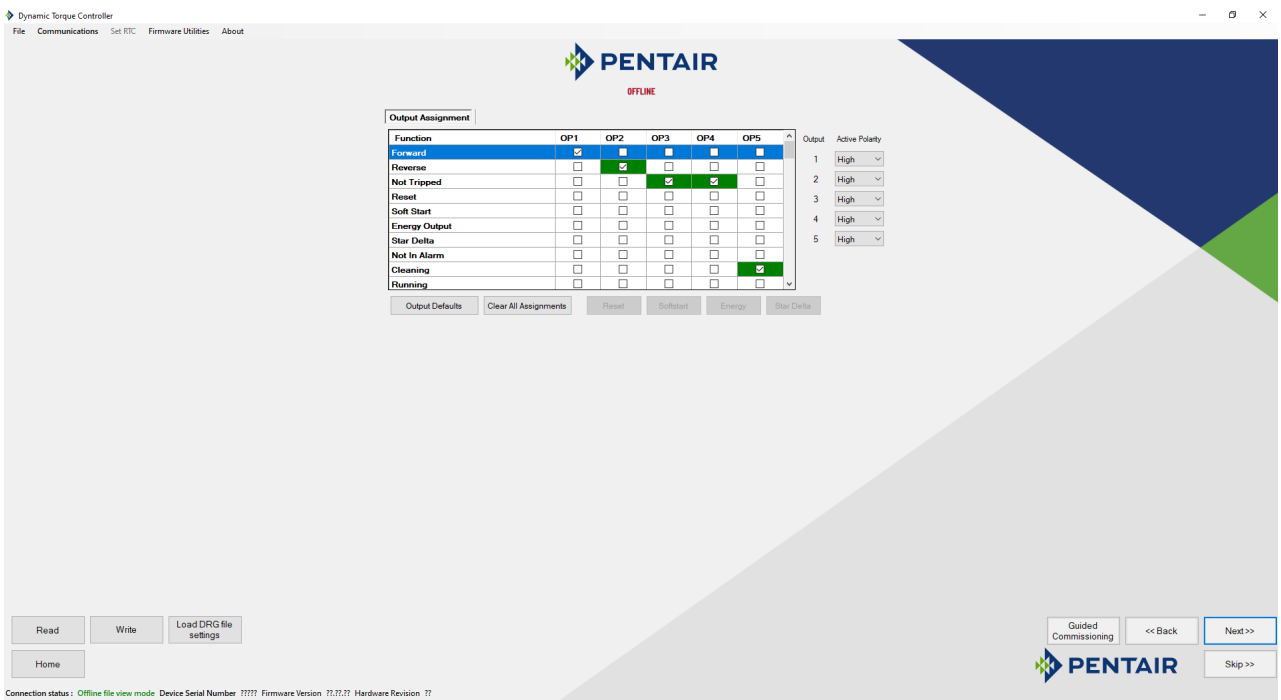




3. Select Write so data is captured by the Dynamic Torque Control Kit and then select Home.
4. From the Home screen, select Advanced Settings and then Digital Input/Output Assignment.

5. Using the dropdown menu, assign the inputs for the wired assets. When complete, select Write to save data.



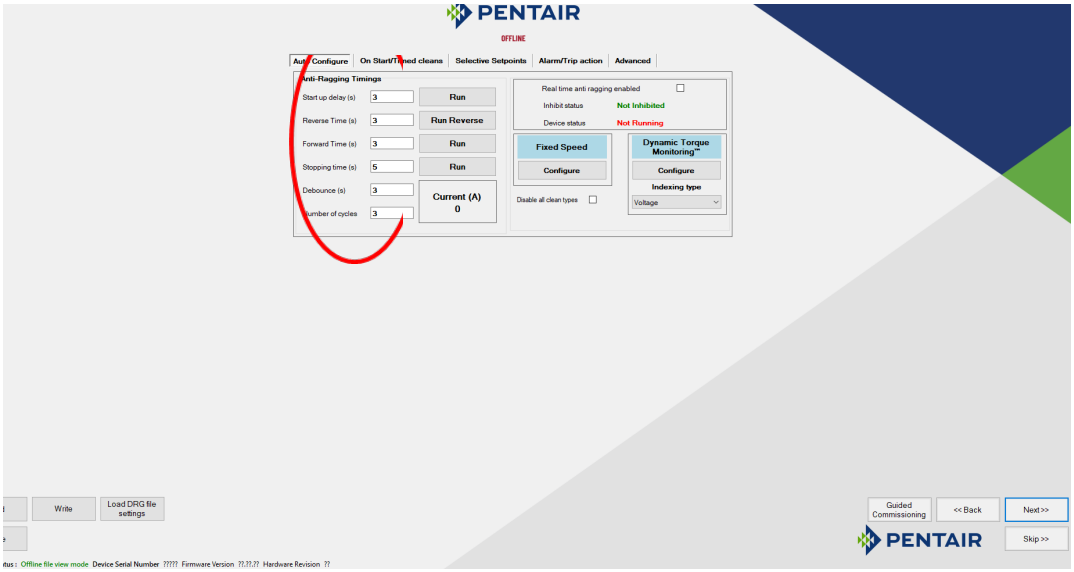

6. Select the Output Assignment tab to input the output assignments. To assign virtual outputs to real outputs, click the specific checkbox. In some instances, you may need to deselect a virtual output before selecting a new one. When complete, select Write to save data.



### ANTI-CLOGGING

1. Before anti-clogging is set up, set the timings to the correct reversals. From the Home screen, select Applications and then Anti-Clogging.

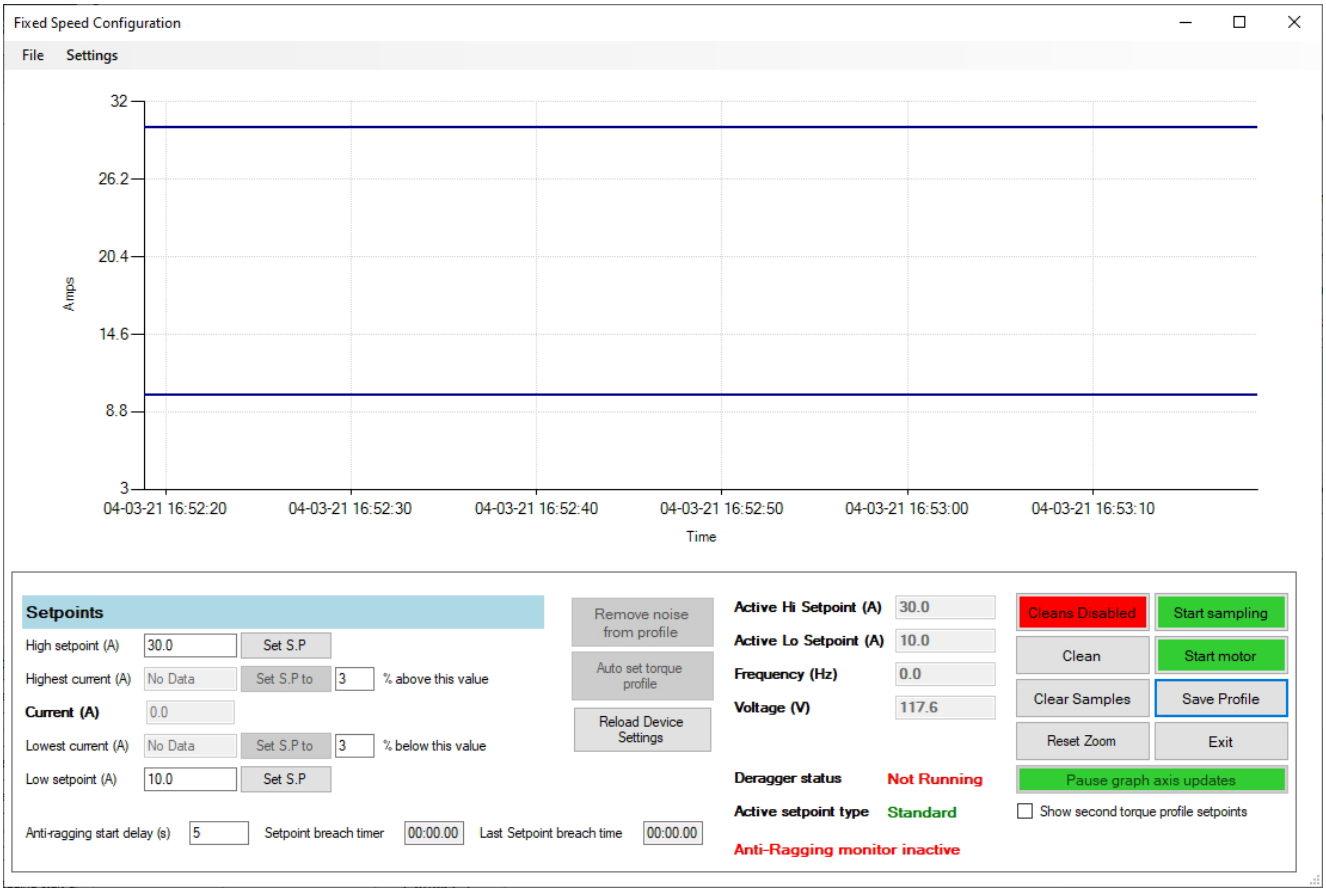
   **⚠ CAUTION Before starting this section make sure mechanical checklist has been complete.**




2. The area highlighted above is the timing settings fields. To set the the clean cycle, select the Run button and wait for the pump to get up to full speed and flow rates to stabilize. Select Stop.
3. Then select Run Reverse and press Stop when the pump gets to the required reverse speed.
4. The Forward Time is generally set the same AS the Run Reverse settings.
5. To set the Stopping Time, select Run and wait for the motor to stabilize before stopping the motor. Once the motor has come to a rest, select Stop.
6. For the field Number Of Cycles: At light clogging sites (once per week or less), set the number of cycles to 1. For sites that need more than once per week clogging, set the cycle value to 2.

### COMMISSIONING ANTI-CLOGGING FIXED SPEED

1. To configure the Dynamic Torque Control Kit's fixed speed, click Configure in the Fixed Speed area of the Auto-Configure tab.
2. Let the well fill to a high level. Once full, press Start Sampling and Start Motor buttons at which point the pump will begin to pump the well down. At well intervals of 3/4, 1/2, and 1/4 full manually trigger a clean cycle. This ensures the pump remains clean while pumping. During this process, the system is in learning mode, understanding the pump characteristics.When the pump gets to a low level, press Stop Motor and Stop Sampling. This stops the learning mode process.
3. To clean the torque profile, press the Remove Noise button until outliers are removed and then select Auto Setpoints. The unit is now set up for single pump operation.



### DYNAMIC TORQUE MONITORING

For VFD/VSD operation use the Dynamic setpoints, set the indexing to voltage.

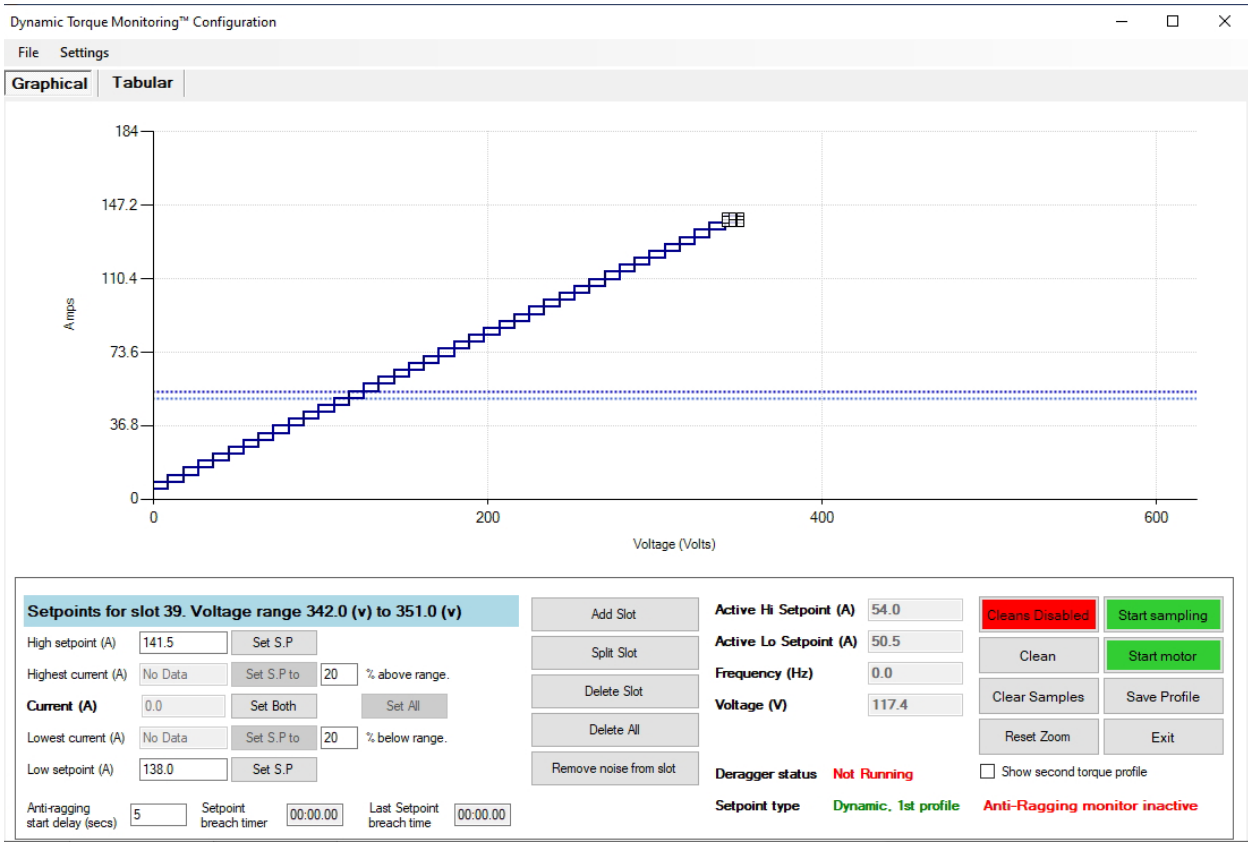
Like the fixed speed configuration, the the well needs to be allowed to fill up to a high level. Once at a high level, press start sampling and start motor. Ramp the VFD up to full speed and then once stabilized reduce the speed by 1Hz at a time stopping to allow stabilization between speed changes. Again trigger a manual clean around ¾ , ½, and ¼ well level. When the well level gets to low level, stop the pump stop sampling. Once you have a torque profile click add slot.

The first slot should have an X plane that goes from 0V to the point of the minimum speed of the VFD. Make the Y plane large enough to have none of the profile within.

Press add slot repeatedly until the whole profile has slots. Then select each slot by clicking on the box and press remove noise from selected slot. This cleans up the profile and you should be left with a nice curve like below.

Each box sensitivity can be adjusted by clicking on the box and clogging the horizontal line to increase the height. Let the well level fill back up and repeat the process of speeding the VFD up to full speed and reducing the speed. At all times ensure the curve is always within the slots . If not adjust each of the slots.

When complete, select Save Profile.



### COMMISSIONING CHECKLIST

Once Commissioning is complete, you must now complete the final section (D) of the Pre-Install and Pre-Commissioning Questionnaire.

**⚠ CAUTION Once this is complete, the form must again be signed as indicated.**

Now the whole of the Pre-Install and Pre-Commissioning Questionnaire has been completed, and signed off throughout, this should now be sent to the Pentair Rep handling the project (if applicable) and also direct to xxxxx

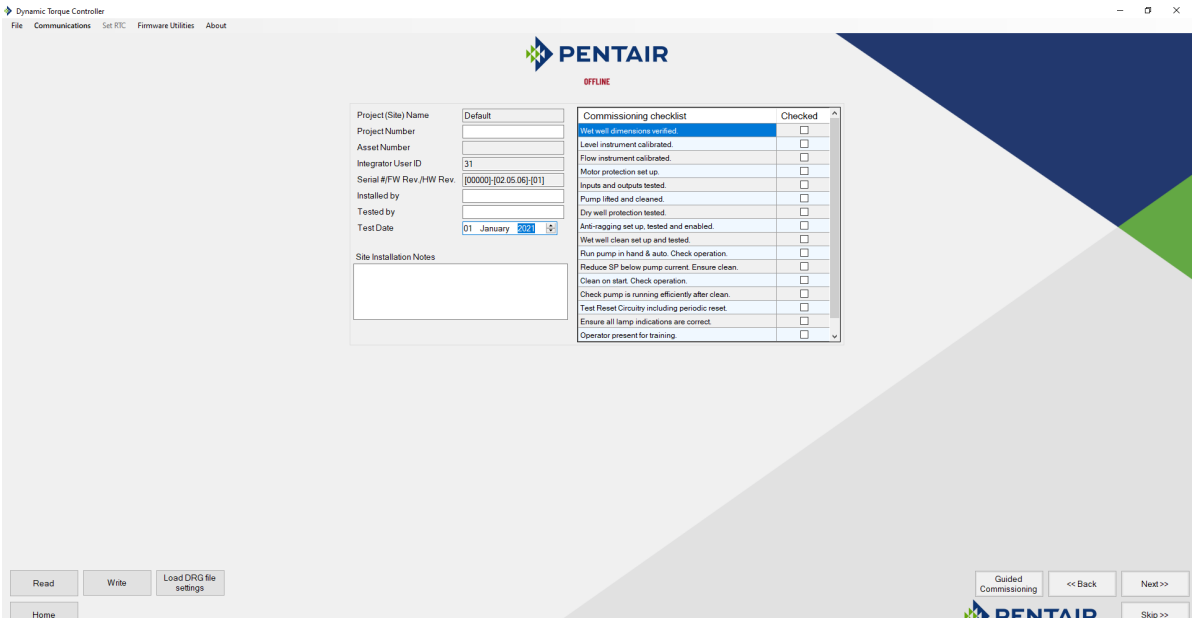
### DYNAMIC TORQUE CONTROL KIT SETTINGS REPORT

1. On completion of the commissioning process, you must fill in the test documentation and create the document pack. The commissioning documents zip folder must be returned to Pentair via xxxxx for warranty to take effect.

2. To do this on the home screen select Test Document.

3. Here each test (right hand column) must be answered yes or no via the drop downs. The project information on the left along with the commissioning engineers information should be filled in. Any notes about the pumps or site should be filled in the site installation notes. This information is included in the document pack.

4. Once this is complete select Save Documentation. button. This will create a zip folder with the commissioning start up documentation. This start up documentation includes a PDF file "Setting Report" this is a hard copy of all settings and parameters that have been set in the unit along with the customer and project information



# TROUBLESHOOTING

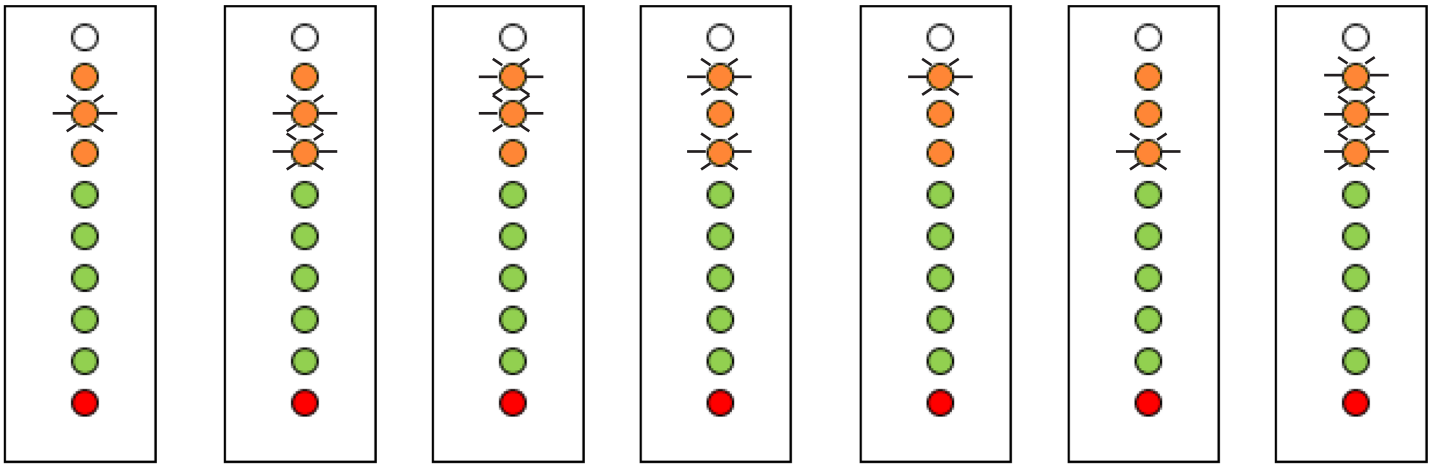
### LED'S

The Dynamic Torque Control Kit has several LEDs for diagnosis purposes.

- The top LED flashes when successfully communicating.
- The next 3 orange LEDs signal the Digital inputs.
- The next 5 green LEDs signal Output status.
- The last LED is the red power indicator.

### ERROR COMBINATIONS

The 3 orange input LED's also serve as diagnostic information. If the device trips, the LEDs flash in a certain combination depending on the error. The graphics below shows the different possible combinations:



Analog Input Monitor Trip | Application Monitor Trip | External Trip (Digital Input or Comms) | Device Internal Fault Trip | Comms Timeout | Motor Supply Monitor Trip | Motor Overload Monitor Trip

# DATA AND SPECIFICATIONS

**DYNAMIC TORQUE CONTROL KIT: 110-230ZVAC VERSION**

| DESCRIPTION | VALUE | TOLERANCE |
|---|---|---|
| Protection degree | IP20 | |
| Mounting arrangement | TS35 Din rail | |
| Operating conditions | 32F- 104F /0 - 40C (Non condensing) | |
| Supply Voltage | 85-265Vac (50/60Hz) | |
| Power consumption | 4.5W typical | |
| Digital Input Voltage | 3 x 110-230Vac optically isolated | +/-10% |
| Insulation | 2.5kV | |
| Relays | 3 x volt free SPNO (250V ,3A max) | |
| 1x volt free SPDT (250V,10A max) | | |
| Solid State relay | 1 x SPNO (250V, 100mA max) | |
| Voltage measurement | Up to 600Vac ph-ph | |
| Status feedback | 10 LED's | |
| Internally fuse size | 1A | |
| Terminals | Torque 0.5Nm | |
| Conductor CSA 0.5-2.5mm2 | | |
| Communications | 2 wire Modbus RTU | |

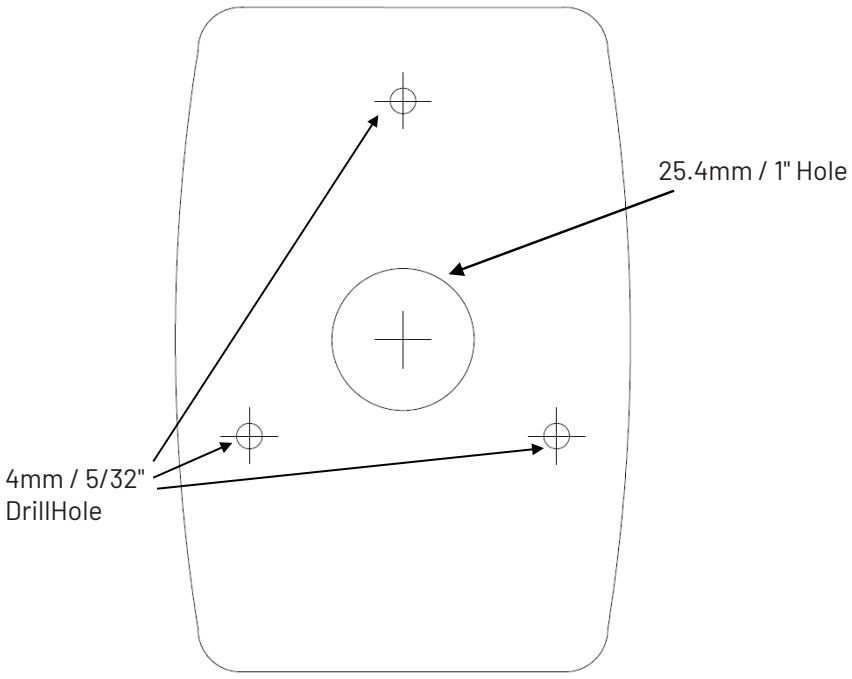
**YOUR KEYPAD PANEL TEMPLATE CUT-OUT**

Terminals

1. +24Vdc Max
2. RS 485 A
3. RS485 B
4. 0Vdc / RS485 GND

Power Consumption: 0.75W

Torque: 0.5Nm



# PRE-INSTALLATION CHECKLISTS

| CUSTOMER CONTACT INFORMATION | |
|---|---|
| Name | |
| Address | |
| Phone Number: | |
| Email Address | |

| SITE/APPLICATION INFORMATION | | | |
|---|---|---|---|
| Site Address | | | |
| Equipment, Quantity, & Type | | | |
| Manufacturer/ Model Number | | | |
| Power | kW/HP Rating: | | Motor FLA: |
| Control Voltage | 120-240 VDC: | | 24 VOC: |
| Line Voltage | Voltage: | 3 Phase? Y/N | Starter Type: |
| If the starter is across the line, do you have a required reversing starter for the install? | Yes / No | | |
| If the starter is a soft start, do you have a required forward and reversing starter for the install?<br>* Delete as appropriate. | ◆ Yes<br>◆ No<br>◆ Soft start has reversing built in | | |
| If the starter is a VFD, what is the make and model? | | | |
| What type of run signal starts your motor?<br>* Delete as appropriate. | ◆ 120 Volt Hard Wired Signal<br>◆ 24 Volt Hard Wired Signal<br>◆ Profient<br>◆ DeviceNet<br>◆ Ethernet | | |
| On the day of the install does the utility / municipality agree to have someone present that can lift the pump(s) to make certain they are clean and torque the impeller nut or bolt to the manufacturer specified torque rating? | ◆ Yes<br>◆ No<br>[If No, you take full liability if the impeller comes loose at any point in the future.] | | |
| Will a data monitoring period prior to commissioning be carried out to allow collection of data on pump operation to detect and highlight any signs of potential pump failure which could prevent the activation of the DTC unit? * Delete as appropriate | ◆ Yes, if so pre-commissioning pump report is to be supplied to utility/ municipality advising of pump status and confirming any pumps which are not suitable for the DTC unit fitted.<br>◆ No, if so then the utility/municipality accepts liability for any subsequent failure of the pumps as a result of the DTC unit being activated. | | |

| CURRENT SITUATION: MAINTENANCE AND ENERGY | |
|---|---|
| Is there space for two additional contacters? | Yes / No |
| Fixed or Variable Speed Operation (e.g. constant level or flow) | Fixed / Variable |
| Application | Dry Well Pumps / Wet Well Pumps |
| How often per month does the pump get clogged? | |
| How many employees are required to safely clean the pump? | |
| How long does it take to access this location for a call-out? | |
| What is the currently hourly run-time per month for this pump? | |
| What is the electrical utility cost to operate this station per month? | |
| Have photos been taken of panel interior? | |

| SIGNATURES | |
|---|---|
| **SIGNED ON BEHALF OF PARTY RESPONSIBLE FOR INSTALLATION AND COMMISSIONING OF THE DR UNIT:** | **SIGNED ON BEHALF OF UTILITY/MUNICIPALITY:** |
| Name: | Name: |
| Organization: | Organization: |
| Signature: | Signature: |

| SIGNATURES | |
|---|---|
| **SIGNED ON BEHALF OF PARTY RESPONSIBLE FOR INSTALLATION AND COMMISSIONING OF THE DR UNIT:** | **SIGNED ON BEHALF OF UTILITY/MUNICIPALITY:** |
| Name: | Name: |
| Organization: | Organization: |
| Signature: | Signature: |

# PRE-INSTALLATION CHECKLISTS

**PRE-COMMISSIONING QUESTIONNAIRE**

| QUESTIONS | PUMP 1 | PUMP 2 | PUMP 3 | PUMP 4 | PUMP 5 | PUMP 6 |
|---|---|---|---|---|---|---|
| Does the pump show any sign of current imbalance based on data monitoring? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Does the pump show any sign of bearings failure based on data monitoring? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Does the pump show any sign of excessive clogging based upon data monitoring and lift and clean history? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |

**MECHANICAL CHECKLIST**

| QUESTIONS | PUMP 1 | PUMP 2 | PUMP 3 | PUMP 4 | PUMP 5 | PUMP 6 |
|---|---|---|---|---|---|---|
| Separated pump and motor from volute? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Cleared any debris from impeller and volute? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Is condition of impeller OK? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| If no, please comment: | | | | | | |
| Is condition of bearing wear OK? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| If no, please comment: | | | | | | |
| Removed impeller and inspected for damage to the key and notch? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Attached impeller, Loctite thread and torque nut/bolt as per manufacturers guidelines? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Please state condition of well: | | | | | | |

| SIGNATURES | |
|---|---|
| **SIGNED ON BEHALF OF PARTY RESPONSIBLE FOR INSTALLATION AND COMMISSIONING OF THE DR UNIT:** | **SIGNED ON BEHALF OF UTILITY/MUNICIPALITY:** |
| Name: | Name: |
| Organization: | Organization: |
| Signature: | Signature: |

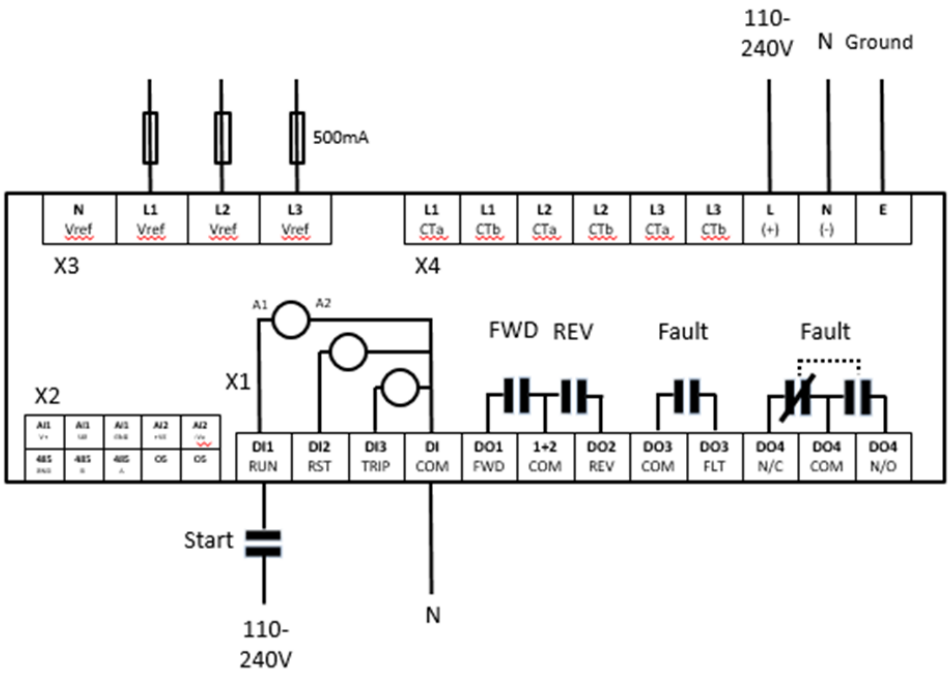
**COMMISSIONING CHECKLIST**

| QUESTIONS | PUMP 1 | PUMP 2 | PUMP 3 | PUMP 4 | PUMP 5 | PUMP 6 |
|---|---|---|---|---|---|---|
| Has DTC been secured to TS35 Din rail? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Has surge arrestor (MOV) been installed to protect the inputs? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Have 100mA Fuses been added to protect Vref inputs? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Has the DTC Run signal been tested and correct? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Has the DTC energised the Forward contactor correctly? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Has the DTC energised the Reverse contactor correctly? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Has the DTC been tripped to test rip circuit? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Has the reset circuit been tested? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| Is there any feedback signal to SCADA that will alarm during clean (e.g. system not running)? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |
| If DTC thermal overload is used has FLC and CT type been entered in Keypad? | Y/N | Y/N | Y/N | Y/N | Y/N | Y/N |

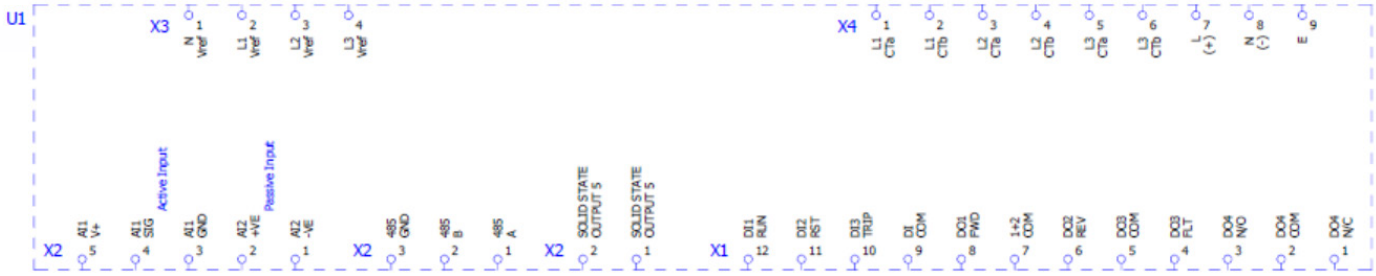
| SIGNATURES | |
|---|---|
| **SIGNED ON BEHALF OF PARTY RESPONSIBLE FOR INSTALLATION AND COMMISSIONING OF THE DR UNIT:** | **SIGNED ON BEHALF OF UTILITY/MUNICIPALITY:** |
| Name: | Name: |
| Organization: | Organization: |
| Signature: | Signature: |

# BASIC CONNECTIONS

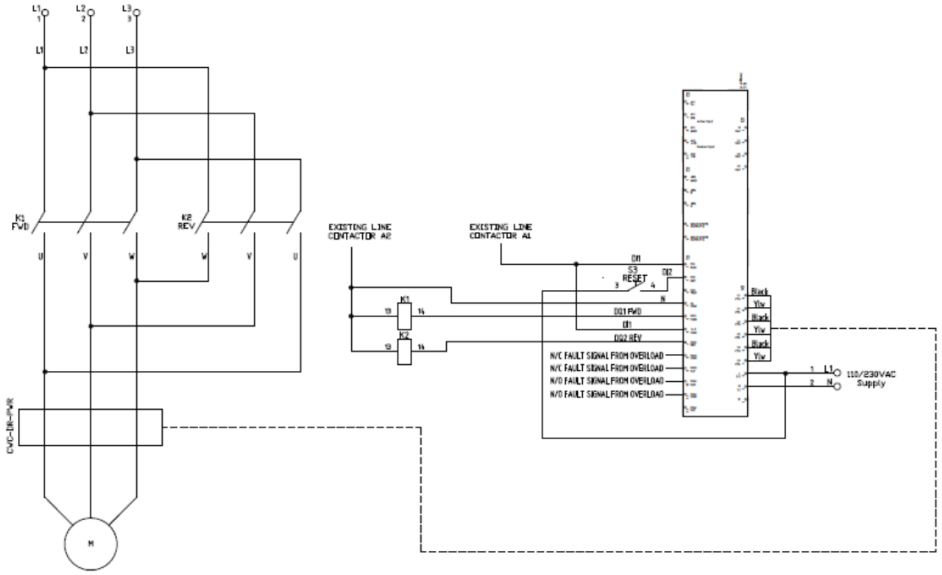
### BASIC TERMINAL LAYOUT




### CAD TEMPLATE

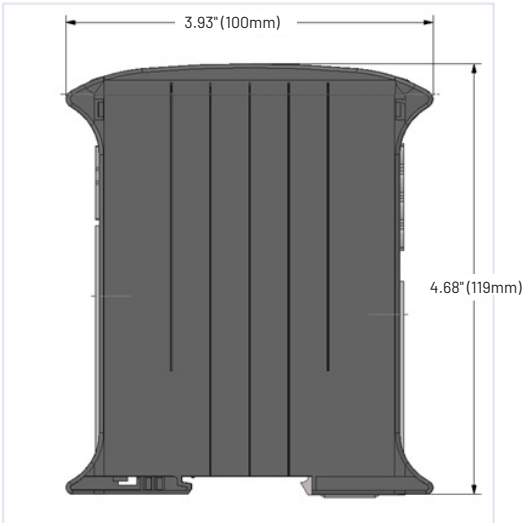



### BASIC CONNECTION DIAGRAM - DOL

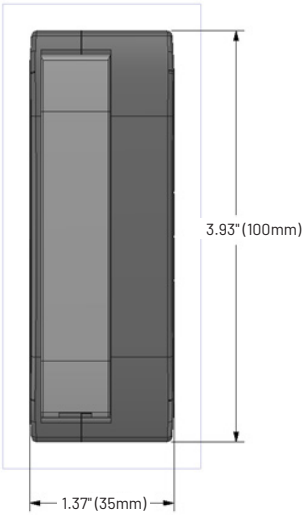


# UNIT DIMENSIONS

**MAIN UNIT**

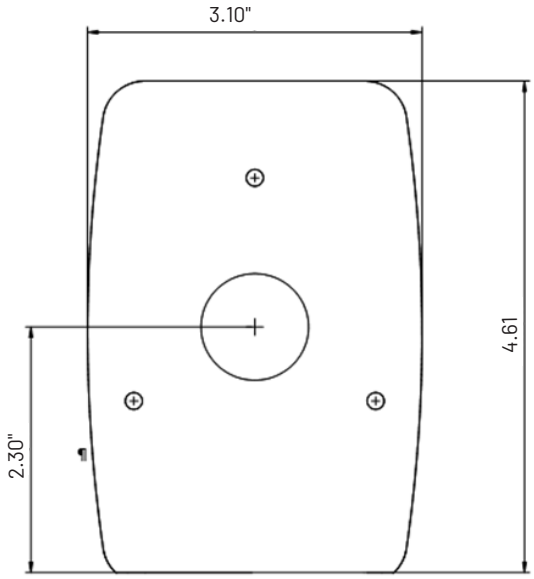



Side View




Front View

**KEYPAD**



# WARRANTY

Pentair Flow Technologies LLC and its direct affiliates {"Pentair"} warrant this product against defects in material and workmanship for a period of 18 months from installation/purchase date – provided that such products are used in compliance with the requirements of the Pentair catalog and technical manuals for use in pumping raw sewage, municipal wastewater or similar, abrasive-free, noncorrosive liquids. During the warranty period and subject to the conditions set forth, Pentair, at its discretion, will repair or replace to the original user, the parts that prove defective in materials and workmanship. Pentair reserves the right to change or improve its products or any portions thereof without being obligated to provide such a change or improvement for prior sold and/or shipped units. Start-up reports and electrical schematics may be required to support warranty claims. Submit at the time of start up through the Pentair website: http://forms.pentairliterature.com/startupform/startupform.asp? type=h. Warranty is effective only if Pentair authorized control panels are used. Under no circumstance will Pentair be responsible for the cost of field labor, travel expenses, rented equipment, removal/ reinstallation costs or freight expenses to and from the factory or an authorized Pentair service facility.

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