TORNATECH

LISTEN DEVELOP LEAD

INSTALLATION AND MAINTENANCE MANUAL FOR VARIABLE SPEED ELECTRIC FIRE PUMP CONTROLLERS MODEL VPX

V2026.10 r0

TABLE OF CONTENTS

Important Safety Information **4**

Introduction **6**

Technical Data 6

Installation **7**

Storage 7

Seismic 7

Environment 7

Electromagnetic compatibility (EMC) 7

Handling 7

FCC Regulations and Radio Standards Specification (RSS) Rules 7

Location 8

Mounting 8

Floor mounting 9

Wall mounting 9

Making System Pressure Connections 9

Making Electrical Connections 9

Important Precautions 10

Procedure 10

Motor connections 11

Starter type: Across-the-line / Soft Start Soft Stop / Autotransformer 12

Starter type: Wye-Delta 13

Operator interface **15**

Methods of starting and stopping **16**

Variable Speed Electric Fire Pump mode switch 16

VFD mode 16

Bypass mode 16

Methods of starting 16

Automatic start 16

Manual start 16

Remote manual start 16
Remote automatic start, deluge valve start 16
Emergency start 16
Sequential start 17
Test start 17
Methods of stopping 17
Automatic stop 17
Manual stop 17
Emergency stop 17
Commissioning **18**
VFD Reforming 18
procedure 18
VFD Settings 18
Graphic display terminal 18
Motor parameters 18
Basic parameters 19
Autotune 19
Procedure 20
Preventive Maintenance Program **22**
Factory recommendations 22
Internal verifications 22
External verifications 22
End-of-life, dismantling and recycling information 22
Replacement Intervals 23
Patents **24**

IMPORTANT SAFETY INFORMATION

Warning:

This product can expose you to chemicals including DINP, which is known to the State of California to cause cancer, and DIDP which is known to the State of California to cause birth defects or other reproductive harm.

Warning:

This product can expose you to chemicals including lead and lead compounds, which are know to the State of California to cause cancer and birth defects or other reproductive harm.

For more information go to: www.P65Warnings.ca.gov

DANGER

RISK OF ELECTROCUTION

PERSONAL INJURY OR DEATH COULD OCCUR.
ENSURE ALL POWER IS DISCONNECTED BEFORE INSTALLING OR SERVICING THIS EQUIPMENT.

DANGER

Do not attempt to install or perform maintenance on equipment while it is energized. Contact with energized equipment may result in death, serious personal injury, or substantial property damage.

Before proceeding, always verify that no voltage is present and follow all applicable safety procedures. De-energize the power supply to the controller.

The controller must be completely disconnected from all power sources, and the disconnect switch must be in the “OFF” position before opening the enclosure door.

If any person chooses to install, inspect, service, or perform maintenance on the equipment while it is energized, they do so entirely at their own risk and assume full responsibility and liability for any resulting death, injury, loss, or property damage, to the fullest extent permitted by law.

Tornatech shall not be liable for any misapplication, improper installation, unauthorized energized work, or failure to follow these instructions and applicable safety procedures.

INTRODUCTION

Variable Speed Electric Fire Pump controllers are designed to automatically manage the pressure of a fire protection system by controlling the operation of an electric motor driven fire pump. It is equipped with a Variable Frequency Drive (VFD) that will regulate the motor speed, by controlling the frequency applied to the motor, in order to maintain a certain set-point pressure. System pressure is continuously monitored through a pressure transducer, and the controller automatically starts the fire pump when the pressure drops below the configured threshold. The fire pump can also be started manually through the local start pushbutton. The fire pump will stop automatically after the expiration of a field-programmable timer (when approved by the authority having jurisdiction) or it can be stopped manually with the local stop push-button once the desired pressure condition is re-established.

TECHNICAL DATA

Rating	Value
Rated Operational Current Ie	According to the Motor (HP/kW)
Rated Operational Voltage Ue	According to the controller rating label
Rated Operational Frequency	50/60Hz
Standard environmental temperature	4°C - 40°C
Altitude	≤ 2000m
Relative humidity	5% to 80%
Pollution degree	3
Short Circuit Current Rating Icc (SCCR) (A)	According to the controller rating label
Standard degree of protection	NEMA Type 12
Standby power consumption	200 W

INSTALLATION

STORAGE

If the controller is not installed and energized immediately, Tornatech recommends following the instructions in chapter 3 of NEMA ICS 15.

SEISMIC

Variable Speed Electric Fire Pump controllers are optionally seismic approved and has been tested in accordance with the ICC-ES AC156, IBC 2015 & CBC 2013 standards. Proper installation, anchoring and mounting is required to validate this compliance report. Refer to this manual and drawings to determine the seismic mounting requirements and location of the center of gravity (you may need to contact factory). The equipment manufacturer is not responsible for the specification and performance of anchorage systems. The structural engineer of record on the project shall be responsible for anchorage details. The equipment installation contractor shall be responsible for ensuring the requirements specified by the structural engineer of record are satisfied. If detailed seismic installation calculations are required, please contact the manufacturer for the performance of this work.

ENVIRONMENT

Variable Speed Electric Fire Pump controllers are intended to be installed in locations where ambient temperatures are within 4°C - 40°C and the relative humidity is controlled between 5% and 80%.

They are intended for pollution degree 3 and shall be installed at an altitude of no more than 2000 meters. For abnormal installation environment, consult factory.

ELECTROMAGNETIC COMPATIBILITY (EMC)

Variable Speed Electric Fire Pump controllers have been tested for the most stringent conditions for emissions (Environment B) and immunity (Environment A), hence controllers can be installed in either environment. All controllers variants share the same electronics and comply to those criteria without requiring additional measures.

HANDLING

The weight of each Variable Speed Electric Fire Pump controller is indicated on the packing label. Lightweight controllers do not require special handling instructions, while heavy controllers are equipped with lifting means and should be handled following the guidelines specified in Tornatech's document "Large Enclosure Safe Handling Requirements_PN12162021".

FCC REGULATIONS AND RADIO STANDARDS SPECIFICATION (RSS) RULES

To comply with FCC and Industry Canada RF exposure compliance requirements, a separation distance of at least 20 cm must be maintained between the antenna of this device and all nearby persons. This device must not be co-located or operating in conjunction with any other antenna or transmitter.

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

1. This device may not cause interference.
2. This device must accept any interference, including interference that may cause undesired operation of the device.

Compliance: CAN ICES-003(B) / NMB-003(B)

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

"Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment."

LOCATION

Consult the appropriate job plans to determine the controller mounting location.

The controller shall be located as close as practical to the engine or motor it controls and shall be within sight of the engine or motor. The controller shall be located or protected such that it will not be damaged by water escaping from pump or pump connections. Current carrying parts of the controller shall be not less than 12 in. (305 mm) above the floor level.

Working clearances around controller shall comply with NFPA 70, National Electrical Code, Article 110 or C22.1, Canadian Electrical Code, Article 26.302 or any applicable local codes.

The standard controller enclosure is rated NEMA Type 12. It is the installer's responsibility to insure that either the standard enclosure meets the ambient conditions or that an enclosure with an appropriate rating has been provided. Controllers must be installed inside a building and they are not designed for outside environment. The paint color may change if the controller is exposed to ultraviolet rays for a long period of time.

MOUNTING

The Variable Speed Electric Fire Pump controller shall be mounted in a substantial manner on a single incombustible supporting structure.

FLOOR MOUNTING

Floor mounted controllers shall be attached to the floor using all holes provided on the mounting feet with hardware designed to support the weight of the controller. The mounting feet provide the necessary 12 in. (305 mm) clearance for current carrying parts.

WALL MOUNTING

Refer to the controller dimension drawing for necessary mounting dimensions.

The controller is wall mounted by using at least four (4) wall anchors, 2 anchors for the top mounting brackets and 2 anchors for the bottom mounting brackets. The brackets are dimensionally on the same centerline for ease in mounting. There should be a clearance of at least 6 inches (152mm) around the controller to allow proper air circulation around the equipment.

1. Using either the dimension print or by measuring the distance between the center lines of the lower bracket slots, transcribe this dimension on to the wall. Note: The bottom edge of the enclosure should be a minimum of 12” (305mm.) from the floor in case flooding of the pump room occurs.
2. Drill and put anchors into the wall for the lower mounting brackets.
3. Mark on the wall, the location of the holes in the upper mounting brackets.
4. Drill and put anchors into wall for the upper mounting brackets.
5. Install bolts and washers in lower anchors.
6. Align holes in upper mounting brackets and install bolts and washers in anchors.
7. Shim anchors as necessary to ensure rear of enclosure is vertical level and enclosure is not stressed.
8. Tighten all anchor bolts.
9. Check to be sure enclosure door open and closes freely and that enclosure is level.

MAKING SYSTEM PRESSURE CONNECTIONS

The controller requires one (1) “System Pressure” connection from the system piping to the enclosure. The connection fitting, 1/2” NPT male port, is provided on the left external side of the enclosure for this purpose. Refer to NFPA 20 for correct field piping procedure of the sensing line between the pumping system and the controller. If a drain is present, the connection to the drain is a tapered connection for plastic tubing.

MAKING ELECTRICAL CONNECTIONS

The electrical wiring between the power source and the fire pump controller shall meet the NFPA 20, NFPA 70 National Electrical Code Article 695 or C22.1 Canadian Electrical Code, Section 32-200 or any applicable local codes. Electrical wiring shall be typically sized to carry at least 125% of the full load current (FLC or FLA) of the fire pump motor.

IMPORTANT PRECAUTIONS

A licensed electrician must supervise the electrical connections. The dimension drawings show the area suitable for incoming power and motor connections. No other location shall be used. Only watertight hub fittings shall be used when entering the cabinet to preserve the NEMA or IP rating of the cabinet.

The installer is responsible for adequate protection of the Variable Speed Electric Fire Pump controller components against metallic debris or drilling chips. Failure to do so may cause Death, serious personal injury, damage the controller and subsequently void warranty.

Prior to making any field connections

1. Open door of enclosure and inspect internal components and wiring for any signs of frayed or loose wires or other visible damage.
2. Verify that the controller information is what is required on the project:
    1. Tornatech catalog number
    2. Motor electrical nameplate information matches controller rating for voltage, frequency, FLA and HP.
3. Project's electrical contractor must supply all necessary wiring for field connections in accordance with the National Electrical Code, local electrical code and any other authority having jurisdiction.
4. Refer to the appropriate field connection drawing for wiring information.

PROCEDURE

All field connections, remote alarm functions and AC wiring are brought into the enclosure through conduit entrances as indicated on the dimensional drawing. For feet or wall-mounted enclosures, properly grounded metallic conduits shall be used.

Do not place conduit entrances on the sides of the enclosure unless a gland plate is provided.

1. Protect all components against any metallic debris or drilling chips.
2. Using a hole (conduit) punch, create a hole in the enclosure for the size conduit being used.
3. Install necessary watertight conduit.
4. Pull all wires necessary for field connections, remote alarm functions, AC power and all other optional features. Bring enough wire inside the enclosure to make up connections to the appropriate line, load and control terminal block points. Be sure to consult the appropriate field connection diagram for connection points and acceptable wire size. For proper wire sizing, refer to the National Electrical Code, NFPA 70.
5. Make all field connections to the remote alarm functions and any other optional features.
6. Connect motor to controller load terminals.
7. Find nameplate on Variable Speed Electric Fire Pump motor and make note of its full load amp rating.

8. Verify AC line voltage, phase and frequency with the controller data plate on the enclosure door prior to connecting.
9. Connect AC power.
10. Check to see that all connections are both correctly wired (in accordance with the field connection diagram) and tight.
11. Close the enclosure door.

MOTOR CONNECTIONS

Tornatech assumes no liability for incorrect wiring of the motor to the controller.

This drawing is for general information.

Consult motor manufacturer before connecting to controller.

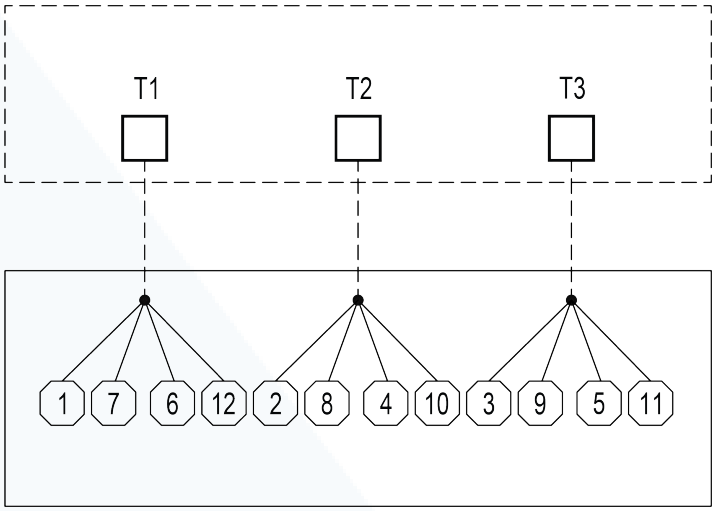
Connect motor leads as shown in motor conduit box.

Important :

NFPA 20 art. 9.5.3.2 : a motor terminal connecting diagram for multiple lead motors shall be furnished by the motor manufacturer.

STARTER TYPE: ACROSS-THE-LINE / SOFT START SOFT STOP / AUTOTRANSFORMER

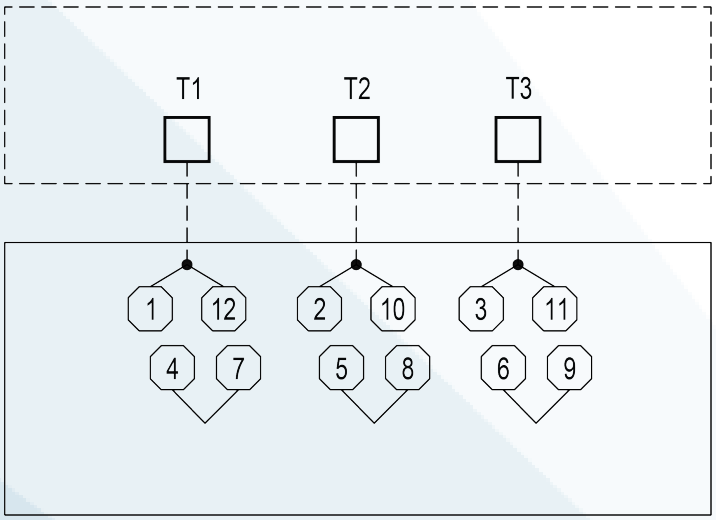
12 leads motor for dual voltage motor
operating on the lower of the two voltages



Fire pump controller

Motor conduit box

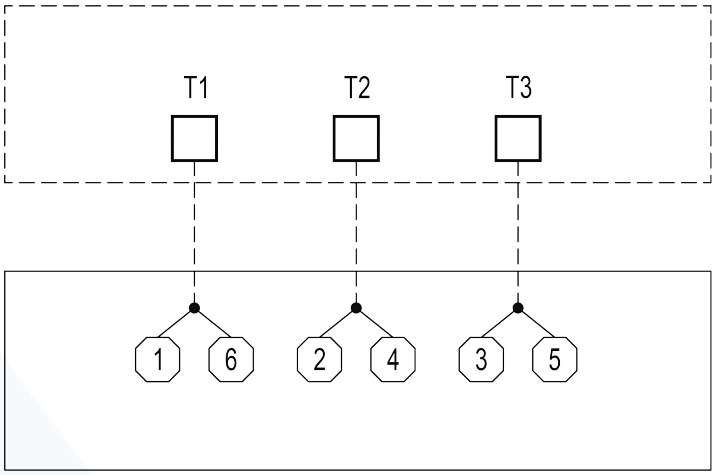
12 leads motor for dual voltage motor
operating on the higher of the two voltages



Fire pump controller

Motor conduit box

6 leads motor for delta connection

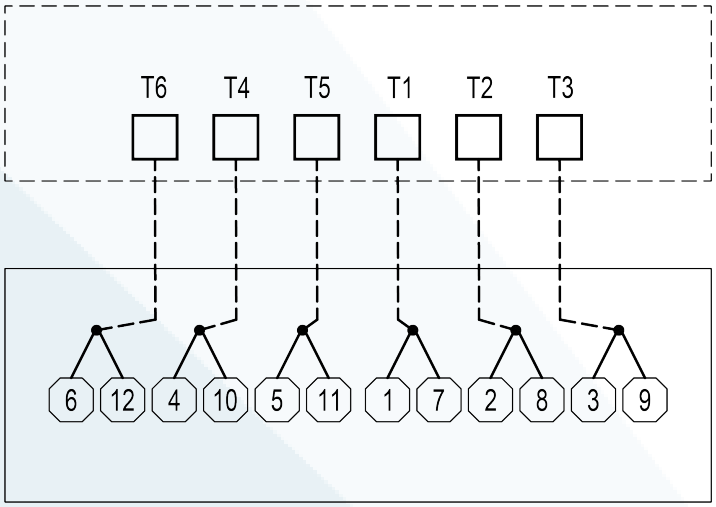


Fire pump controller

Motor conduit box

STARTER TYPE: WYE-DELTA

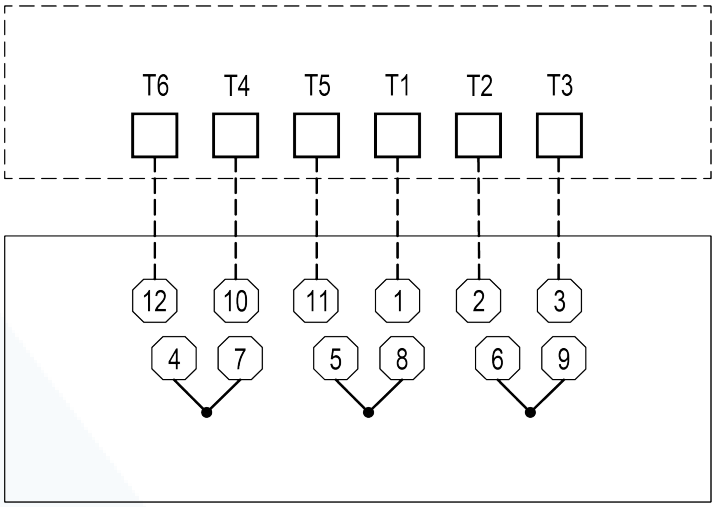
12 leads motor for dual voltage motor
operating on the lower of the two voltages



Fire pump controller

Motor conduit box

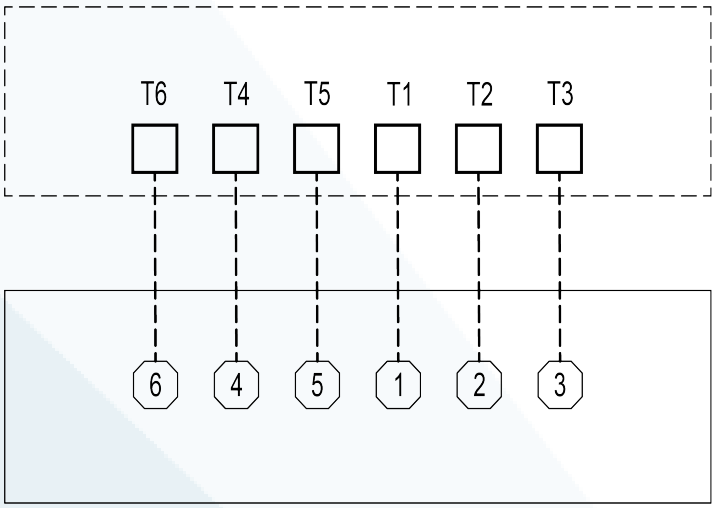
12 leads motor for dual voltage motor
operating on the higher of the two voltages



Fire pump controller

Motor conduit box

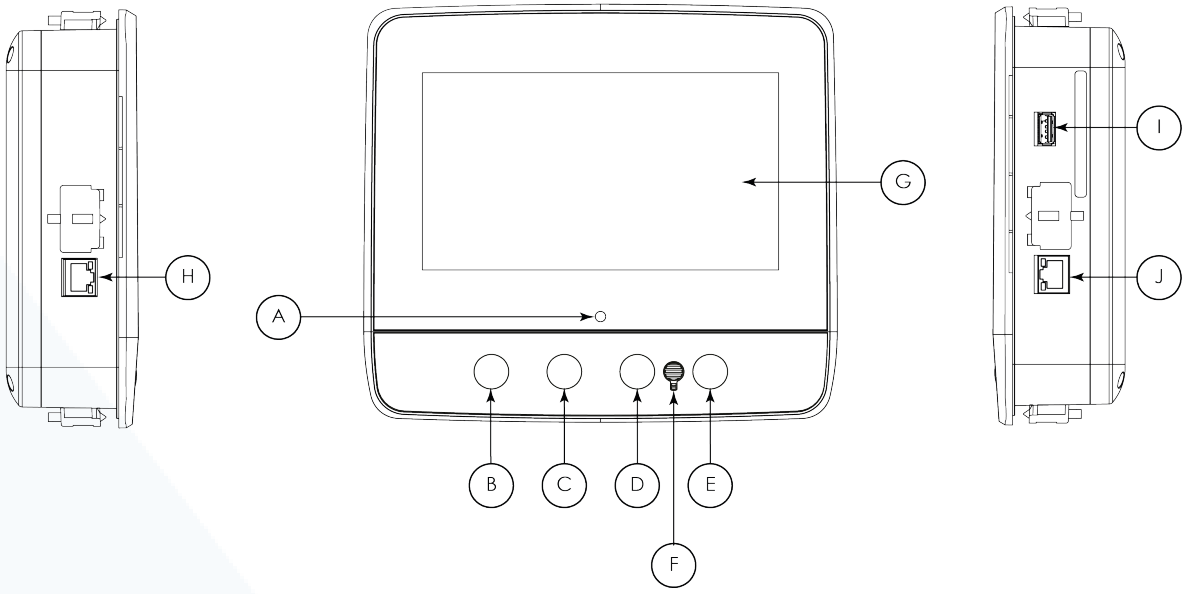
6 leads motor for Wye-Delta motor



Fire pump controller

Motor conduit box

OPERATOR INTERFACE



A. Status LED
B. Manual start
C. Stop
D. Not used
E. Run test
F. Alarm buzzer
G. Touch screen display
H. Factory reserved
I. USB key connector for logs download and software updates
J. Ethernet connector for standard TCP/IP communication

METHODS OF STARTING AND STOPPING

VARIABLE SPEED ELECTRIC FIRE PUMP MODE SWITCH

The VPX is equipped with a VFD mode switch that is located under the Vizitouch. It is protected by a lockable cover, and has 2 positions; VFD and BYPASS. If the mode switch changes position while the motor is running, the motor will stop and restart in the new mode

VFD MODE

This is the normal mode of operation. The controller will use the VFD as the primary starting means, and automatically switch to the bypass starting means in case of a VFD alarm. Once the controller has automatically switched to the bypass starting means, it will remain in this state until the VFD alarms are manually reset.

Note: When the motor is driven by the VFD, it may run at minimum speed when the system pressure is above the set point pressure.

BYPASS MODE

If required, the bypass starting means can be manually selected using the mode switch.

METHODS OF STARTING

AUTOMATIC START

The controller will start automatically on low pressure detection by the pressure sensor when the pressure drops below the cut-in threshold.

MANUAL START

The motor can be started by pressing the manual start pushbutton, regardless of the system pressure.

REMOTE MANUAL START

The motor can be started from a remote location by momentarily closing a contact of a manual pushbutton.

REMOTE AUTOMATIC START, DELUGE VALVE START

The motor can be started from a remote location by momentarily opening a contact connected to an automatic device.

EMERGENCY START

The motor can be started manually by using the emergency handle. This handle can be maintained in a closed position.

Important: to avoid damaging the contactor, it is recommended to start the motor in this manner:

1. Shutdown the main power by using the main disconnect means,
2. Pull the emergency start handle and lock it in closed position,
3. Turn the power back on by using the main disconnect means.

SEQUENTIAL START

In case of a multiple pump application, it may be necessary to delay the automatic starting of each motor to prevent simultaneous starting of all motors.

TEST START

The motor can be started in test mode manually by pressing the run test pushbutton, or automatically by using the periodic test feature.

METHODS OF STOPPING

AUTOMATIC STOP

This function is never activated by default and must be authorized by the authority having jurisdiction prior to activating.

Automatic stop is possible only after an automatic start. When this function is enabled, the motor is automatically stopped 10 minutes after the restoration of the pressure above the cut-out setting given that no other run cause is present. The 10 minutes delay is adjustable.

MANUAL STOP

Manual stop is done by pressing the priority stop pushbutton. Note that pressing the stop push button will prevent the motor from restarting as long as the button is pressed, plus a two second delay. This action has priority over any active demand (example: if pressure is still below cut-out setting), but the motor will restart automatically once the button is released if the demand is still there.

EMERGENCY STOP

The emergency stop is always possible in any starting condition and is done by using the main disconnecting means located on the door.

COMMISSIONING

Only an authorized field acceptance provider shall proceed with Variable Speed Electric Fire Pump controller commissioning. If you do not have the required training and authorization, contact factory.

Until commissioning is completed, the controller main screen is replaced by the commissioning menu and the automatic mode is disabled.

VFD REFORMING

Reforming a VFD is the action of applying voltage to the VFD power path without running a motor. If the drive was not connected to a voltage source for an extended period of time, the capacitors must be restored to their full performance before the motor is started, otherwise the VFD may be damaged.

If the VFD has not been started for a year or more, a *VFD Reforming Required* warning will be issued and the controller will automatically start in bypass until the reforming is done. Proper controller maintenance as per this document will prevent reforming from being required under normal conditions.

PROCEDURE

1. Place the mode switch in *VFD mode*
2. Enter a valid level 2 password
3. From the *VFD Config* page, press the *VFD Reforming* button.
4. Wait for the reforming to complete

Note: The reforming operation will be interrupted if a starting request occurs, the mode switch is changed, or the user cancel the operation. Only a full reforming procedure will reset the *VFD Reforming Required* alarm.

Note 2: The reforming time is preset to 1 hour and is the required time for an inactivity period of 1 year. For a greater inactivity period, consult factory for the proper reforming time. An insufficient reforming time may lead to a damaged VFD .

VFD SETTINGS

GRAPHIC DISPLAY TERMINAL

The VFD has graphical display terminal used for configuring the equipment. It is normally attached to the VFD and can be relocated on the exterior of the enclosure via the provided door mounting kit. Always ensure that the door mounting kit is either properly closed or has the display properly mounted to maintain the NEMA Type 12 rating of the controller.

MOTOR PARAMETERS

On the VFD graphic display terminal, go to the *Simply Start* Menu. Verify that all the information on this menu is the same as the one on the motor name plate:

1. Motor Standard
    1. 50 Hz: The nominal motor power will be expressed in KW
    2. 60 H: The nominal motor power will be expressed in HP.
2. Nominal Motor Power
3. Nominal Motor Voltage
4. Nominal motor current
5. Nominal motor frequency
6. Nominal motor speed
7. Max frequency
   Should be set to the nominal motor frequency.

BASIC PARAMETERS

Continue on the Simply Start menu and modify or validate the next parameters:

1. Acceleration ramp time
2. Deceleration ramp time
3. Low speed
4. High speed

Refer to the VFD Parameters List for the factory settings values.

AUTOTUNE

The autotune procedure allows the VFD to acquire electrical motor characteristics and enhance the VFD performance. It is recommended to perform the autotune only once during the first startup.

Perform the autotune on a stopped and cold motor as heat can influence the tuning result.

While doing the Autotune the VFD will scan the motor and acquire information about the motor.

Before starting the Autotune on the VFD, read the whole procedure. Then perform step by step.

1. Place the Mode switch on the VFD position.
2. On the Vizitouch. Enter a level 2 password.
3. Go to the *VFD Config* page and press the *VFD Autotune* button. The VPx will close the VFD isolating contactors. This will energize the VFD power path and allow it to be connected to the motor. The VFD isolating contactors will remain closed for 3 minutes. During that time, you can perform the Autotune on the VFD display.
4. On the VFD Graphic Display Terminal, go to the *Simply Start* menu
5. Go to the *Autotuning* parameter and press OK to enter the *Autotuning* page.
6. Select *Apply Autotuning* and press OK.

7. A Warning will be displayed on screen. Press OK.
8. Autotune will be performed. You can validate it is completed by going on the *Simply Start* menu and assert that the *Autotuning Status* is set to *Autotuning Done*.
9. On the Vizitouch, press the *Stop* button on the Autotune popup.

Note: during this process, the motor might make small movements. Noise development and oscillations of the system are normal. This may take for several seconds, do not interrupt the process.

PROCEDURE

To commission the controller:

1. Ensure the internal battery is connected by removing the insulation plastic tab, if installed.
2. Secure the door in closed position then put the circuit breaker disconnecting means in ON position.
3. Make sure the procedure is completed with the VFD set to constant speed mode.
4. Log in using your password and complete the initial setup wizard. Steps requiring validation display a green check mark once completed.
    a. **Verify the power supply settings.** Confirm that the nominal frequency matches the power supply frequency and that the normal power supply voltage is within the acceptable range.
    b. **Verify motor rotation.** For three-phase motors, use the motor rotation test function to check the direction of rotation. If the motor rotates in the incorrect direction, de-energize the controller and verify that power is isolated before interchanging two motor leads on the load side of the contactor. Restore power and verify motor rotation again. For VFD, do this verification on the bypass starting mean.

        VFD starting: In case of incorrect motor rotation on the VFD starting means, go on the graphical display terminal and change the *Output phase rotation* PHr parameter on the *Complete settings > Motor parameter > Motor Control* menu.
    c. **Configure the pressure settings**.
        - Verify that the pressure displayed on the controller matches the reading on the calibrated pressure gauge installed on the sensing line.
        - Select the pressure units.
        - Adjust the maximum pressure display value, if required.
        - Enter the fire pump cut-in and cut-out pressure values.
        - If desired, enter the jockey pump cut-in and cut-out pressure values for pressure recording purposes.

Note: The jockey pump cut-in and cut-out pressure values must be set on the jockey pump controller. Entering these values on the fire pump controller does not change the jockey pump settings.

d. **Verify the date, time, and battery status.** Confirm that the date and time are correct and that the controller's internal battery status is normal.

e. **Configure the remaining operating settings.**

- If automatic shutdown is required, enable it and set the duration for which the pump continues to run after the automatic stop condition is met.
- Set the periodic test frequency, day of the week, start time, and duration.
- Set the manual run test duration.

5. Once all the necessary steps are completed and that you are logged in with your password, the "Service Done" button will become online.
6. Press the "Service Done" button once you are satisfied with the readings and parameters.
7. Download the logs to save in your report.
8. To finalize the controller commissioning, it is important to refer to the *VPx Complete Setup procedure* to adjust the advanced parameters of the VFD. This will assure the VFD response correctly and in a timely manner to a pressure drop.

Important note concerning models equipped with a soft-starter

Controllers equipped with a soft-starter may alarm a soft-starter failure if the equipment was not given enough time to cool between subsequent starts.

This is a result of the soft-starter protecting itself from higher than normal temperatures and does not necessarily mean that it is damaged. If this occurs, let the equipment cool down, reset the alarm, and continue operating it normally.

Different factors influence the cooling time requirements such as the motor load, ambient temperature, make and model of the soft-starter equipment installed, ramp-up and ramp-down parameters, etc. Refer to the soft-starter manual for more information.

PREVENTIVE MAINTENANCE PROGRAM

Pursuant to NFPA 25, Standard for the Inspection, Testing, and Maintenance of Water-based Fire Protection Systems, 2023 edition, a preventive maintenance program must be established according to the manufacturer's recommendations for all components of the pump assembly. The program must begin after the pump assembly has passed all acceptance tests (See NFPA 25 Section 8.5.1 – 8.5.3 and Table 8.1.1.2 – *Maintenance*). Failure to comply could result in loss of life and/or property. The warranty may also be deemed null and void.

The following information outlines the parts and intervals for preventive maintenance recommended by Tornatech to ensure the fire pump controller and associated components are in optimum condition. The program should be used in conjunction with the general requirements for inspecting and testing outlined in NFPA 25.

FACTORY RECOMMENDATIONS

The factory also recommends the following tasks be performed on an annual basis for all controller types:

INTERNAL VERIFICATIONS

- Check for corrosion on components or circuit boards.
- Check for breakdown/fraying of conductor insulation.
- Check for any signs of water leakage into controller.
- Remove all objects placed inside the panel not associated with the fire pump.

EXTERNAL VERIFICATIONS

- Check for signs of water leakage on the system pressure sensing lines.
- Clean the outside of the controller to remove any dust or other substances that may have accumulated.
- Remove all objects placed on top of the panel not associated with the fire pump.

END-OF-LIFE, DISMANTLING AND RECYCLING INFORMATION

This product contains electrical and electronic components, including but not limited to printed circuit boards, cables, relays, user interface modules, I/O boards, surge protection devices, pressure transducers, and other control components. Some of these components may contain materials that are recoverable through specialized recycling processes.

At the end of its service life, this product and its replaced components should not be disposed of with unsorted municipal waste. They should be collected, handled and treated through an appropriate waste electrical and electronic equipment (WEEE) or authorized recycling channel, in accordance with applicable local regulations.

Before any dismantling, disposal or recycling activity, the product must be disconnected from all power sources and placed in a safe condition by qualified personnel. Dismantling should be performed only by qualified personnel using appropriate safety procedures.

For products integrated into a larger pump assembly or fire protection system, the system owner, installer, integrator or end user is responsible for coordinating proper end-of-life handling of the complete system and its components.

Tornatech can provide additional information on product components upon request to support maintenance, replacement, recycling or end-of-life treatment activities.

REPLACEMENT INTERVALS

2 years

- Pressure Transducer

4 years

- Solenoid Valve

5 years

- Surge Arrester
- Power Relays (qty 2)
- User Interface
- I/O Board

10 years

- Complete Controller

PATENTS

Country	Title	Grant NO
CA	Mechanical activator for contactor	2741881
US	Mechanical activator for contactor	US8399788B2
CA	Mechanical activator for electrical contactor	165512
CA	Mechanical activator for electrical contactor	165514
US	Mechanical activator for electrical contactor	D803794
US	Mechanical activator for electrical contactor	Patent pending
EP	Mechanical activator for electrical contactor	002955393-0001/2
AE	Mechanical activator for electrical contactor	Patent pending
AE	Mechanical activator for electrical contactor	Patent pending
CA	Fire pump digital operator	163254
US	Fire pump digital operator interface	D770313
AE	Fire pump digital operator interface	Patent pending
EP	Fire pump digital operator interface	002937250-0001
CA	System and method for detecting failure in a pressure sensor of a fire pump system	Patent pending
US	System and method for detecting failure in a pressure sensor of a fire pump system	Patent pending

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