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QUICK START GUIDE
P2004681 REV 2

Technologic® PPS Parallel Pump Controller Quick Start Guide

Bell & Gossett
a xylem brand

INDEX

1. SAFETY AND INSTRUCTIONS

OVERVIEW

This guide provides necessary information about safety and a quick reference for installing the Technologic PPS Pump Controller.

NOTE: Refer to P2003633 Integrated Technologic® Controller with Parallel Pumping System (PPS), P2001487 Technologic® Intelligent Pump Controller and P2001748 Integrated Technologic® with Sensorless Control (ITSC) & Integrated Technologic (IT) Control Installation, Operation, and Maintenance (IOM) Manuals (current versions) on the www.xylem.com/bellgossett website for complete information.

CAUTION:
Read this manual carefully before installing and using the product. Improper use of the product can cause personal injury and damage to property, and may void the warranty.

NOTICE:
Save this manual for future reference, and keep it readily available at the location of the unit.

SAFETY

WARNING:
• The operator must be aware of safety precautions to prevent physical injury.

• Operating, installing, or maintaining the unit in any way that is not covered in this manual could cause death, serious personal injury, or damage to the equipment. This includes any modification to the equipment or use of parts not provided by Xylem. If there is a question regarding the intended use of the equipment, please contact a Xylem representative before proceeding.

• Do not change the service application without the approval of an authorized Xylem representative.

CAUTION:
You must observe the instructions contained in this manual. Failure to do so could result in physical injury, damage, or delays.

Safety message levels

About safety messages

It is extremely important that you read, understand, and follow the safety messages and regulations carefully before handling the product. They are published
to help prevent these hazards:
• Personal accidents and health problems
• Damage to the product
• Product malfunction

Definitions

Safety message level	Indication
DANGER:	A hazardous situation which, if not avoided, will result in death or serious injury
WARNING:	A hazardous situation which, if not avoided, could result in death or serious injury
CAUTION:	A hazardous situation which, if not avoided, could result in minor or moderate injury
Electrical Hazard:	The possibility of electrical risks if instructions are not followed in a proper manner
NOTICE:	• A potential situation which, if not avoided, could result in undesirable conditions • A practice not related to personal injury

Qualified personnel

WARNING:
This product is intended to be operated by qualified personnel only.

• Correct and reliable transport, storage, installation, operation, and maintenance are required for the trouble-free and safe operation of the frequency converter. Only qualified personnel are allowed to install or operate this equipment.

• Qualified personnel are defined as trained staff, who are authorized to install, commission, and maintain equipment, systems, and circuits in accordance with pertinent laws and regulations. Also, the personnel must be familiar with the instructions and safety measures that are described in this document.

• Persons with diminished capacities should not operate the product unless they are supervised or have been properly trained by a professional.

• Children must be supervised to ensure that they do not play on or around the product.

Safety precautions

WARNING:
HIGH VOLTAGE. Frequency converters contain high voltage when connected to AC mains. Installation, start-up and maintenance must be performed by qualified personnel only. Failure to comply could result in death or serious injury.

WARNING:
DISCHARGE TIME. Disconnect and lock out electrical power and wait for the minimum
waiting time specified below. Failure to wait the specified time after power has been removed before performing service or repair could result in death or serious injury.

Frequency converters contain DC-link capacitors that can remain charged even when the frequency converter is not powered. To avoid electrical hazards, stop motor and disconnect:

- AC mains
- Any permanent magnet type motors
- Any remote DC-link power supplies, including battery backups, ups and DC-link connections to other frequency converters.

Wait for the capacitors to discharge completely before performing any service or repair work. Refer to the following table for the minimum waiting time before doing service on the frequency converter:

Voltage (V)	Power range		Minimum waiting time (min)
	hp	kW	
200-240	0.5–5	0.37-3.7	4
200-240	7.5-60	5.5-45	15
380-480	0.5-10	0.37-7.5	4
380-480	15-125	11-90	15
380-480	150–450	110-315	20
380-480	500–600	355-530	40
525-690	0.5-10	0.37-7.5	7
525-690	15-60	11-45	15
525–690	75–400	55-400	20
525–690	450–600	450-560	40

Note: Highigh voltage may be present even when the warning LED indicator lights are off. Always verify with a voltmeter that all voltages have dissipated.

WARNING:
LEAKAGE CURRENT HAZARD. Follow national and local codes regarding protective earthing of equipment with a leakage current > 3.5 mA. Frequency converter technology implies high frequency switching at high power. This will generate a leakage current in the earth connection. A fault current in the frequency converter at the output power terminals might contain a DC component which can charge the filter capacitors and cause a transient earth current. The earth leakage current depends on various system configurations including RFI filtering, screened motor cables, and frequency converter power. Failure to ground the drive properly could result in death or serious injury.

EN/EC61800–5–1 (Power Drive System Product standard) requires special care if the leakage current exceeds 3.5 mA. Earth grounding must be reinforced in one of the following ways:

- Earth ground wire of at least 8 AWG or 10 mm2.
- Two separate earth ground wires both complying with the dimensioning rules.

WARNING:
UNINTENDED START. Before using the Genie, set DI18 to Stop (terminal 18 open) to prevent the unit from starting the motor. Keep terminal 18 open to avoid an unintended motor rotation. Apply the Start signal to the controller only when pump operation is desired.

WARNING:
UNINTENDED START. WINDMILLING! Unintended rotation of permanent magnet motors causes a risk of personal injury and equipment damage. Ensure permanent magnet motors are blocked to prevent unintended rotation.

WARNING:
EQUIPMENT HAZARD. Rotating shafts and electrical equipment can be hazardous. All electrical work must conform to national and local electrical codes. Installation, start-up, and maintenance must be performed by trained and qualified personnel. Wear safety glasses whenever working on electric control or rotating equipment. Failure to follow these guidelines could result in death or serious injury.

WARNING:
Only use original spare parts to replace any worn or faulty components. The use of unsuitable spare parts may cause malfunctions, damage, and injuries as well as void the guarantee.

WARNING:
INTERNAL FAILURE HAZARD. Risk of personal injury when the frequency converter
is not properly closed. Before applying power, ensure all safety covers are in place and securely fastened.

1.3 User safety

General safety rules

These safety rules apply:

- Always keep the work area clean.
- Pay attention to the risks presented by gas and vapors in the work area.
- Avoid all electrical dangers. Pay attention to the risks of electric shock or arc flash hazards.
- Always bear in mind the risk of drowning, electrical accidents, and burn injuries.

Safety equipment

Use safety equipment according to the company regulations. Use this safety equipment within the work area:

- Hard hat
- Safety goggles, preferably with side shields
- Protective shoes
- Protective gloves
- Gas mask
- Hearing protection
- First-aid kit
- Safety devices

NOTICE:
Never operate a unit unless safety devices are installed. Also see specific information about safety devices in other chapters of this manual.

Electrical connections

Electrical connections must be made by certified electricians in compliance with all international, national, state, and local regulations. For more information about requirements, see sections dealing specifically with electrical connections in the manual. See QR code on front page for more information.

Precautions before work

Observe these safety precautions before you work with the product or are in connection with the product:

- Provide a suitable barrier around the work area, for example, a guard rail.
- Make sure that all safety guards are in place and secure.
- Make sure that you have a clear path of retreat.
- Make sure that the product cannot roll or fall over and injure people or damage property.
- Make sure that the lifting equipment is in good condition.
- Use a lifting harness, a safety line, and a breathing device as required.
- Allow all system and pump components to cool before you handle them.
- Make sure that the product has been thoroughly cleaned.
- Disconnect and lock out power before you service the pump.
- Check the explosion risk before you weld or use electric hand tools.

Precautions during work

Observe these safety precautions when you work with the product or are in connection with the product:

- Never work alone.
- Always wear protective clothing and hand protection.
- Stay clear of suspended loads.
- Always lift the product by its lifting device.
- Beware of the risk of a sudden start if the product is used with an automatic level control.
- Beware of the starting jerk, which can be powerful.
- Rinse the components in water after you disassemble the pump.
- Do not exceed the maximum working pressure of the pump.
- Do not open any vent or drain valve or remove any plugs while the system is pressurized. Make sure that the pump is isolated from the system and that pressure is relieved before you disassemble the pump, remove plugs, or disconnect piping.
- Never operate a pump without a properly installed coupling guard.

1.3.1 Wash the skin and eyes

Follow these procedures for chemicals or hazardous fluids that have come into contact with your eyes or your skin:

Condition	Action
Chemicals or hazardous fluids in eyes	1. Hold your eyelids apart forcibly with your fingers. 2. Rinse the eyes with eyewash or running water for at least 15 minutes. 3. Seek medical attention.
Chemicals or hazardous fluids on skin	1. Remove contaminated clothing. 2. Wash the skin with soap and water for at least 1 minute. 3. Seek medical attention, if necessary.

1.4 Protecting the environment

Emissions and waste disposal

Observe the local regulations and codes regarding:

- Reporting of emissions to the appropriate authorities
- Sorting, recycling and disposal of solid or liquid waste
- Clean-up of spills

Exceptional sites

CAUTION: Radiation Hazard
Do NOT send the product to Xylem if it has been exposed to nuclear radiation, unless Xylem has been informed and appropriate actions have been agreed upon.

Recycling guidelines
Always follow local laws and regulations regarding recycling.

Waste and emissions guidelines
Do not dispose of equipment containing electrical components together with domestic waste.
Collect it separately in accordance with local and currently valid legislation.

CAUTION

Before using the Genie, set DI18 to Stop (terminal 18 open) to prevent the unit from starting the motor. Keep terminal 18 open to avoid an unintended motor rotation. Apply the Start signal to the controller only when pump operation is desired.

PREPARE FOR INSTALLATION

WARNING! Installation must be performed by a qualified technician.

- Suitable Environment – Ensure installation is indoors and the site temperature range is 0°C (32°F) to 40°C (104°F).
- Ensure properly sized safety devices are installed in the system such as pressure relief valves, compression tanks, pressure controls, temperature controls and flow controls.
- Ensure proper guards are installed when the system has potential to operate at extreme temperatures and/or pressures.

UNPACK THE UNIT

Remove all packing materials from the product. Inspect the product to determine if any parts have been damaged or are missing. Contact your sales representative if anything is out of order.

PREPARE THE MOUNTING LOCATION

- Ensure adequate supports are utilized to handle the weight of the system, piping and fluid.
- Ensure the suction and discharge pipes are supported independently by use of pipe hangers near the pump.
- Ensure there is adequate space around the unit to ensure proper cooling and allow for maintenance and service.

MOUNT THE UNIT

- Ensure the unit is properly lifted according to the pump Installation, Operation and Maintenance manual.
- Ensure all flange bolts are adequately torqued.
- For vertically mounted installations with the motor and controller in the horizontal position, ensure that adequate support for the motor and controller is provided.
- Refer to chapter 4 Mechanical Installations in the P2001487 IOM (current version) on the Xylem website for details of installations.

INSTALL WIRING

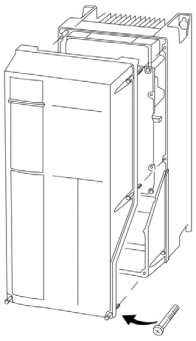
Electrical Hazard. Dangerous voltage.

Ensure all input power disconnects and circuit breakers are locked in the off position prior to installing the input power wiring.

NOTE: External fusing is required for units without a built in fused disconnect.

Electrical Hazard

Ensure power wiring and fusing is installed according to NEC/CEC, state, local or municipal codes.



Remove the front cover to gain access to the power and control wiring terminals. Connect conduit runs from the disconnect or service panel to the drive and route the power wires through the conduit.

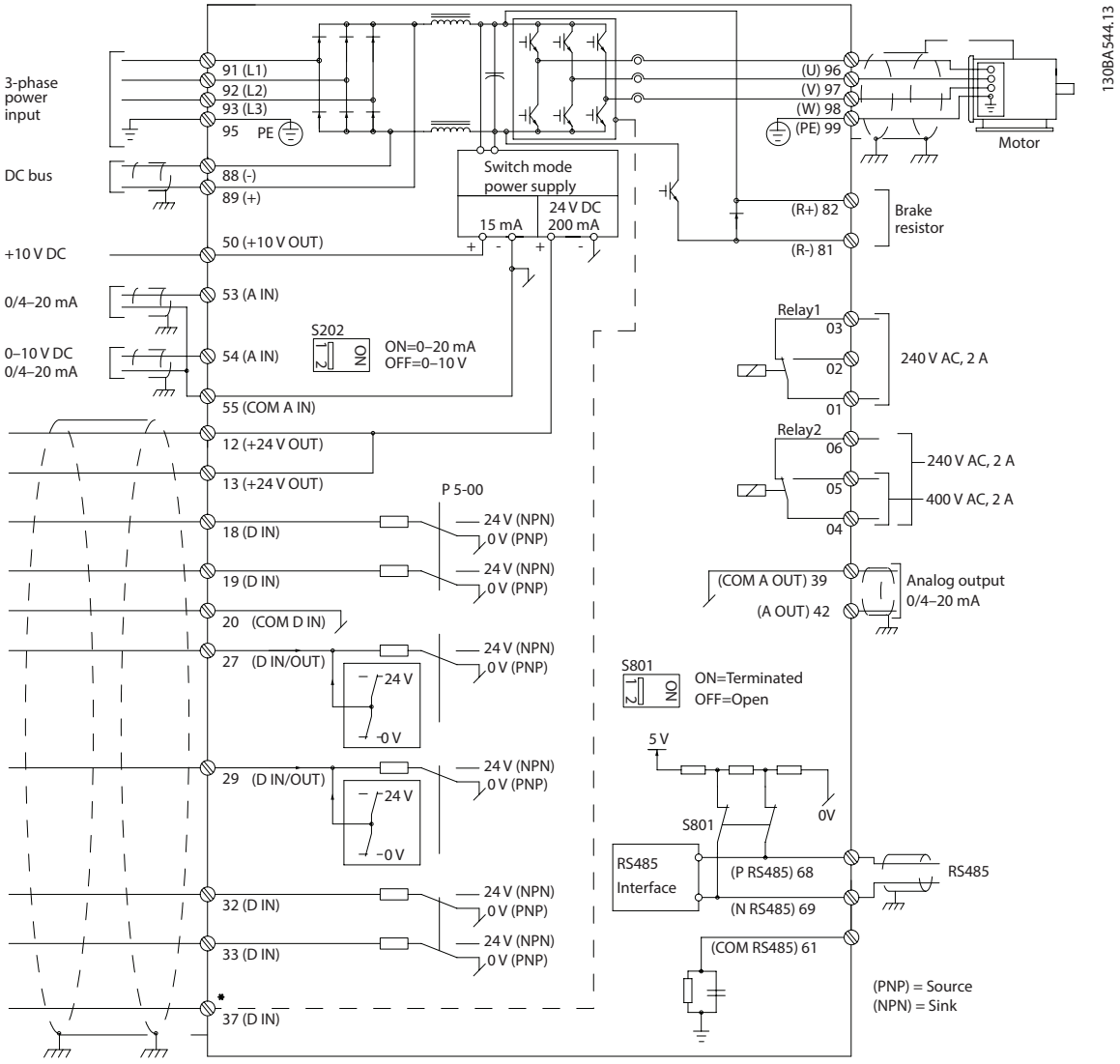
Refer to chapter 5 Electrical Installation and chapter 9 Technical Specifications in the P2001487 IOM (current version) on the Xylem website for details on wiring and routing.

2. SET UP AND WIRING

NOTE: This section shown for reference only.

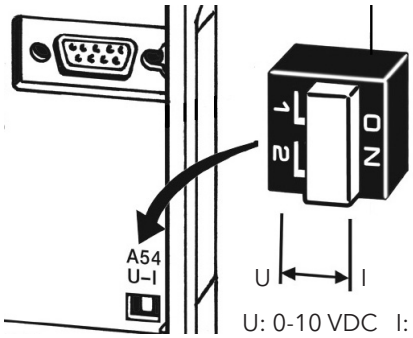
2.1 IPC Wiring

Refer to the Technologic IPC Quick Start Guide for Wiring Instructions for the motor connection and power supplied to the Drive.



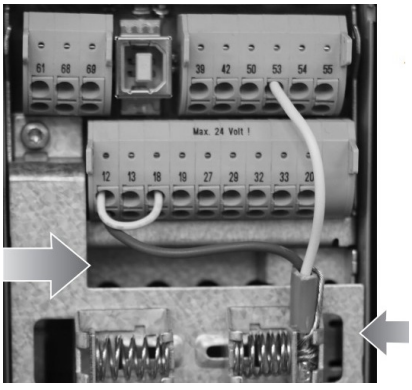
Analog Inputs
AI 53: fixed current input only.
AI54: select current input or voltage input at DIP SW54.

Install transducer cable on:
- Brown/Red on terminal 12 (24V)
- White/Black on terminal 53 (4-20MA) or terminal 54 (4-20MA or 0-10VDC).
- Place ground shield between spring clip and shielded cable.



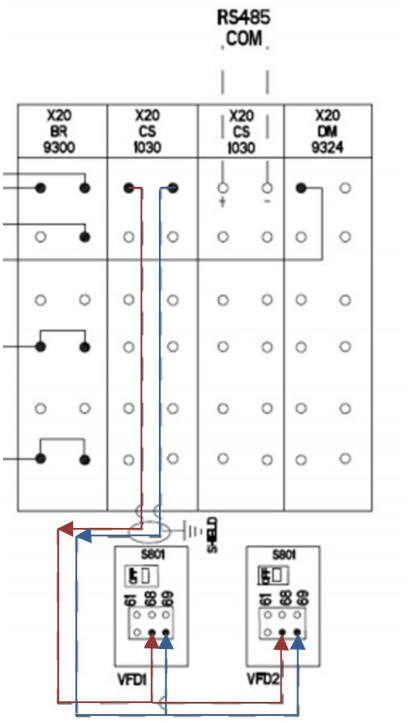
U: 0-10 VDC I: 4-20MA

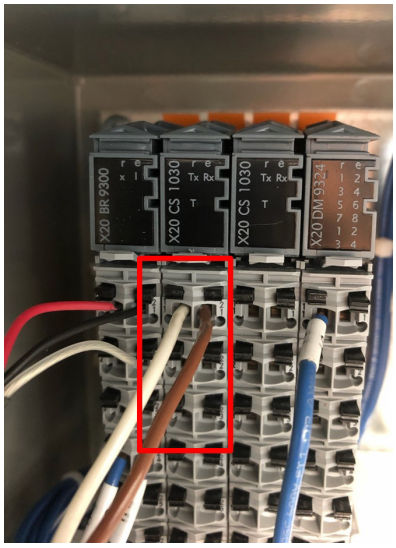
Switches are located behind the keypad



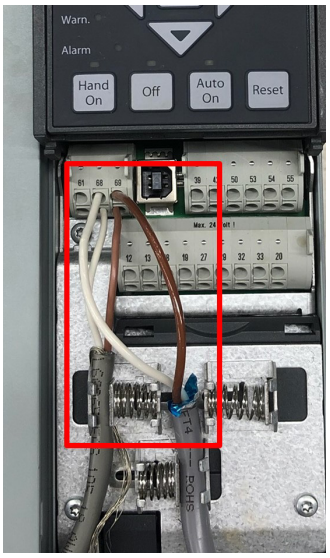
2.2 Control Wiring

Confirm that the PPS Pump Controller is connected to the IPC via wiring from the X20 CS 1030 on the PPS Pump Controller to the 68 and 69 terminals on the IPC (as shown right and below). The wiring is daisy chained if there are multiple pumps in the system. This connection establishes communication between the HPPS Pump Controller and Drives using the Modbus RTU Protocol.

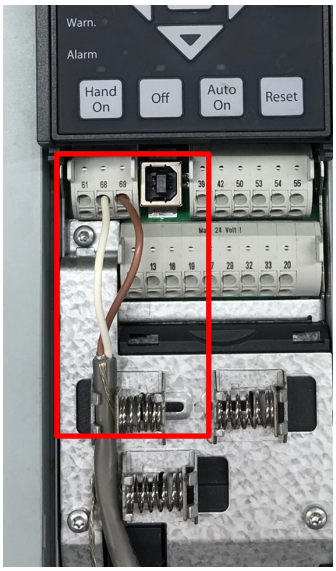




The communication wiring starts in the X20 CS 1030 on the PPS Pump Controller. The white wire represents the red arrow on the schematic, and the brown wire represents the blue arrow.

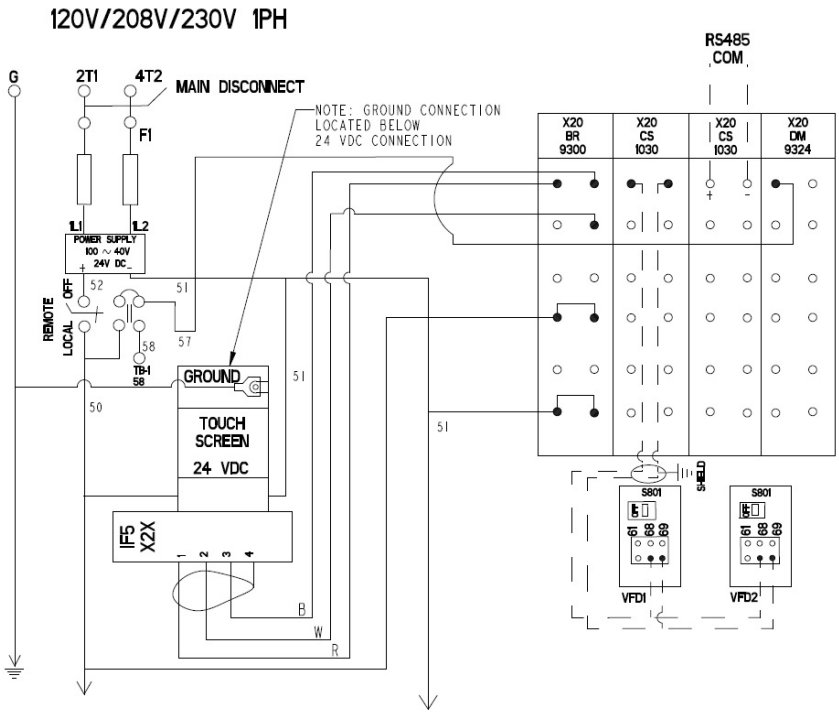


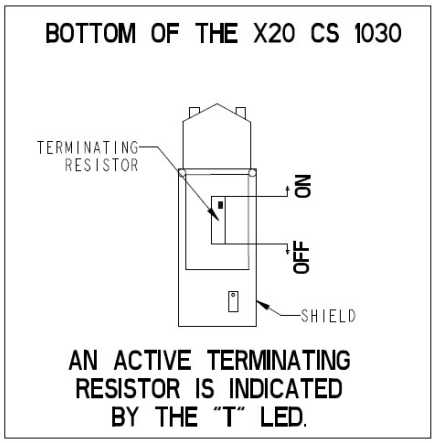
The first IPC that is wired to the PPS Pump Controller has the white wire from the PPS Pump Controller going into the 68 port, and another white wire going out of the 68 port to the next IPC. The brown wires are going in and out of the 69 port.



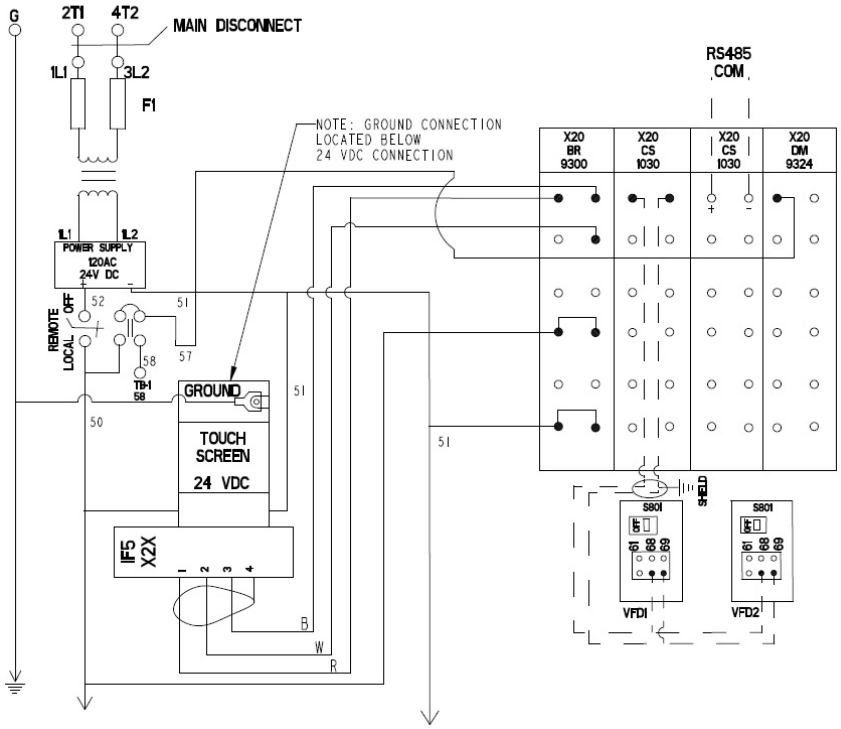
The final IPC used in the parallel pumping system has white and brown wires going into 68 and 69, respectively. No wires are going out of this drive because this is where the communication ends.

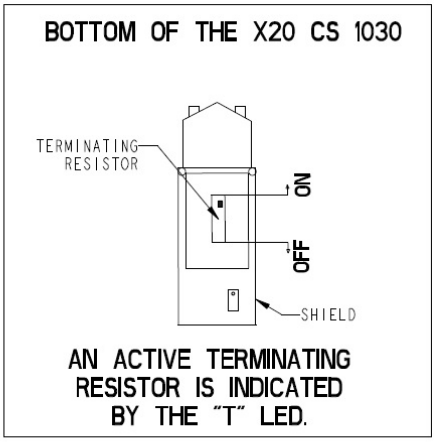
2.3 PPS Pump Controller Power and Control Wiring





575V 1PH





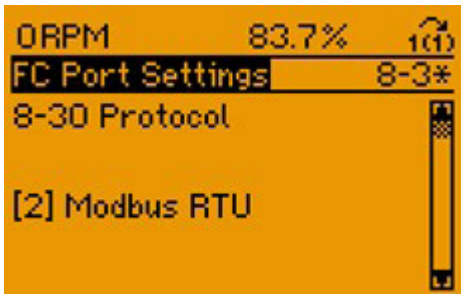
3. IPC AND PPS PUMP CONTROLLER PROGRAMMING

3.1 IPC Programming for ITSC Drives

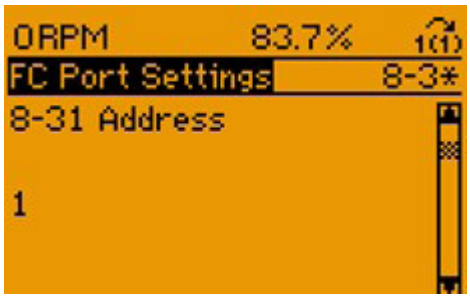
When the IPC turns on, it will be in the Start Up Genie by default.

Hit the Main Menu button to exit the Start Up Genie and manually go through the menus to set the following parameters.

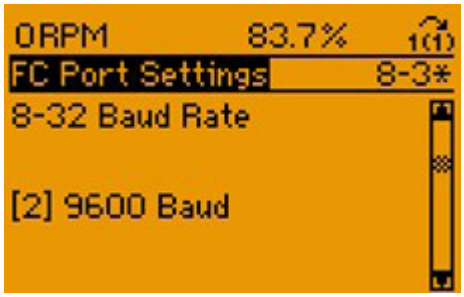
Communication Settings



Menu 8-30
Set to (2) – Modbus RTU



Menu 8-31
Set pump address (1,2,3 etc.) depending on the number of pumps in the system

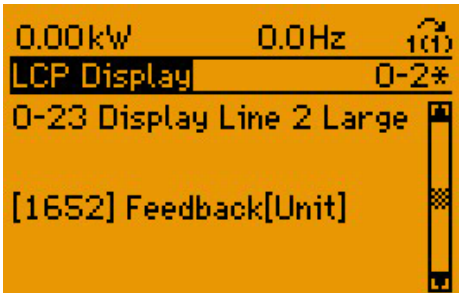


Menu 8-32
Set to (2) – 9600 Baud

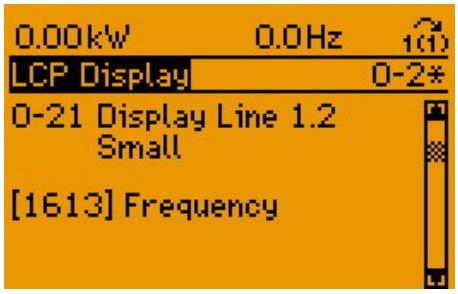
Menu 8-33
Set to (2) –
No Parity,
1 Stop Bit

Verify the following parameters are correct and change per below if needed.

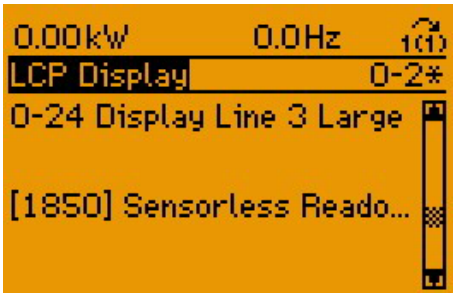
Menu 0-20
Set to (1610) –



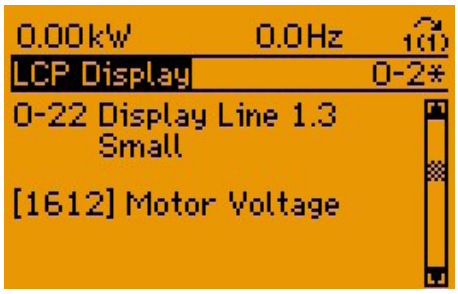
Menu 0-23
Set to (1652) –
Feedback Pressure



Menu 0-21
Set to (1613) –
Frequency [Hz]



Menu 0-24
Set to (1850)
– Sensorless Readout



Menu 0-22
Set to (1612) –
Motor Voltage

3.2 PPS Pump Controller Programming

Once the IPC programming has been confirmed, power on the PPS controller. Follow the steps below to complete the set up.

Log in as Technician:

Select Service, then Log On/Off to get to login screen (shown left).

Select Technician and enter password '2' to complete login.

3.2.1 BMS Communication Setup

IP Setting is selected as default.

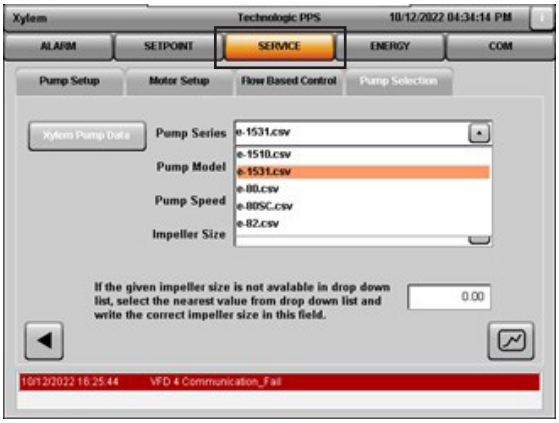
Select BMS Communication Protocol:

From the dropdown menu select the required BMS Communication Protocol.

The corresponding communication window will open for configuring the communication.

Tap the Save Settings button to save the BMS Communication protocol.

3.2.2 Application Setup



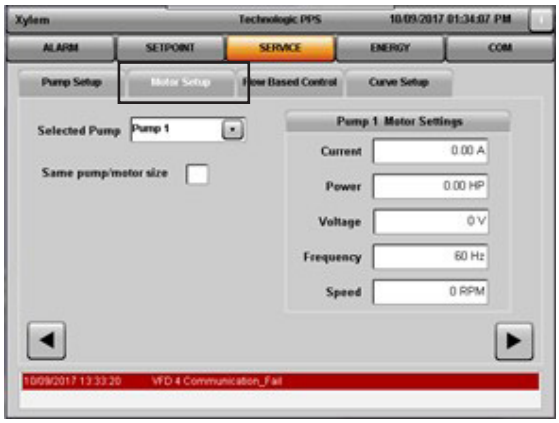
Pump Setup:

Select **Service**, then **Pump Setup**.

Select **Pump Selection** tab, enter information relevant to pumps in the system.

Note: This will set the curve data for the sensorless application and must be done before anything else in the Pump Setup.

Select **Pump Setup** tab, enter number of pumps and standby pumps in system.



Select **Motor Setup** tab, enter motor data. Check the box next to 'Same pump/motor size' if motors on all pumps are identical.

Select **Flow Based Control** tab, enter application parameters.

Duty Pressure – obtain from pump nameplate

Pressure at no flow – 40% of duty pressure

Curve Shape – 100% for quadratic curve

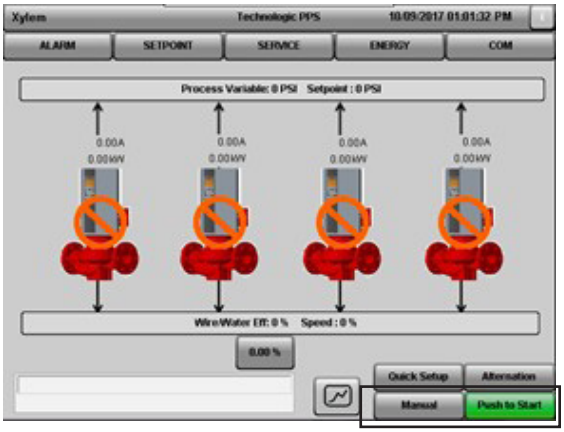
Motor Efficiency – no change

Duty Flow – maximum single-pump flow

Set Point will be calculated based on duty pressure and flow, and the varying demand of the system.

Set Pump Alternation:

Select **Service**, then **System Setup**, and choose the **Exercise/Alternation** option. Enter the desired alternation schedule information.



Enable Pumps:

Tap **Technologic PPS** on the top of the screen to return to main display.

Tap each pump and select **Start** to enable.

Tap **Manual** button to change to Automatic Mode.

Push **Start** button to run the system.

Notice - Industrial Control Protocols

Certain Industrial Control Protocols do not offer security protections at protocol level and may be exposed to additional Cybersecurity risk. Customer security precautions including physical security measures are an important layer of defense in such cases. Xylem's PPS Pump Controller is designed with the consideration that it would be deployed and operated in a physically secure location.

- Xylem suggests that physical access to cabinets and/or enclosures containing PPS Pump Controller and the associated system should be restricted, monitored and logged at all times.
- Xylem recommends that customers inventory and document all industrial equipment running on their premises including model name, software version, and how devices are connected to each other and the local network.
- Xylem recommends creating and maintaining offline copies of configuration backups to all equipment involved in controlling critical processes.
- In cases where control commands for Xylem equipment are issued from SCADA or building management systems, Xylem recommends a regular check by operators to ensure the integrity of communications between these systems and Xylem equipment.
- Physical access to the communication lines should be restricted to prevent any attempts of wiretapping, sabotage. Best practice is to use metal conduits for the communication lines running between one cabinet to another cabinet.
- People with unauthorized physical access to the device could cause serious disruption of the device functionality. A combination of physical access controls to the location should be used, such as locks, card readers, and/or guards etc.
- Xylem's PPS Pump Controller supports the following physical access ports:
  - o RJ45 connector for removable keypad as well as MODBUS® RTU communications
  - o RJ45 for MODBUS TCP communications
  - o Terminal block for MODBUS RTU and other Digital IOs
- Xylem suggests access to above physical ports need to be restricted.

Cybersecurity

Xylem values system security and resilience. Defending against cybersecurity threats is a shared responsibility. Xylem builds products that are secure by design. Our customers have a responsibility to understand the risks inherent in their processes and take steps to operate and maintain their solutions securely. This section reviews security features and provides guidance to help securely operate this product. For details and updates on Xylem product cybersecurity visit xylem.com/security

Xylem Product Cybersecurity

Xylem performs appropriate due care in building security and resilience into products. Xylem performs the following security activities for defense-in-depth:

- security engineers perform **threat modeling** to identify **testable controls**
- code is scanned for flaws with **static analysis** tools and hardened
- **product components are analyzed** and hardened
- security controls are verified through **automated and manual tests**
- Xylem maintains relationships with customers, integrators, and the cybersecurity research community and the **Product Security Incident Response Team (PSIRT)** coordinates the collection, analysis, remediation, and responsible disclosure of vulnerability and remediation information to keep products secure
- cloud connections, data flows, and cloud infrastructure are continuously monitored by the **Product Security Operations Center (PSOC)**
- Product security is governed **through a three lines of defense** model that includes: product developers, product security engineers, and audit staff

Security Recommendations for End-User

Technologic PPS Pump Controller is developed considering the security best practices. The following guidance provides recommendation for secure operations, hardening and account management. In the table below: *Safeguards* describe the security guidance, *Security Context & Rationale* provide overview of security features and value of the security safeguard, and *References* provide additional resources for further investigation for implementing the recommended safeguards.

Safeguard	Security Context & Rationale	References
Restrict physical access **• Ensure physical access to assets is limited. Include physical isolation to protect the environment and equipment therein.** **• Ensure strict control over physical access in and out of the facility.**	The communication ports have been hardened to restrict access and ensure integrity of device operations. This safeguard supports the ability to further limit exposure associated with physical threats to the device such as rogue/malicious device joining the Modbus RTU network over RS485 interface.	ATT&CK for ICS: M0801 NIST SP 800-53 Rev5: AC-3, PE-3 ISA/IEC 62443-3-3: SR 2.1
Ensure that the device is not exposed to internet, using below recommendations: **• Secure the network access to the device using VPN connections.** **• Implement firewall & define rules to protect device from Denial-of-service attempts.** **• Protect the network address information of device using Network Address Translation (NAT) technique.**	This safeguard ensures that data and SCADA controls are not exposed to internet. This also helps in preventing Man-in-the-middle attacks when the device is accessed via Modbus over TCP/IP or BACnet IP. We recommend using network segmentation and segregation so that we can minimize access to sensitive information for those systems and people who don't need it, while ensuring that the organization can continue to operate effectively.	ATT&CK for ICS: M0930 NIST SP 800-95 NIST SP 800-44 v2 ISA/IEC 62443-3-3: SR 5.1, SR 7.1
Ensure cybersecurity policies, awareness, and training to the operators, administrators and other personnel.	This safeguard prevents Social Engineering attacks and promotes awareness related to cybersecurity.	ATT&CK for ICS: M0917 NIST SP 800-53 Rev5: AT-2 ISA/IEC 62443-2-4: SP.01
Ensure patch management is done regularly and updated appropriately.	This safeguard prevents attacks related using components with known vulnerabilities. Sometime vulnerabilities are discovered, and we work with our partners to deploy updates to security and resilience. This safeguard mitigates exploitation risks and ensures security patching	ATT&CK for ICS: M0951 NIST SP 800-53 Rev5: MA-2 ISA/IEC 62443-2-3
Ensure hardening guidelines are implemented, only desired ports and services should be open, and RBAC should be followed.	This safeguard helps in prevention of attacks due to misconfigurations or default configurations.	ATT&CK for ICS: M0937, M0918, M0801 NIST SP 800-53 Rev5: AC-3(7), SC-7(5) ISA/IEC 62443-3-3: SR 2.1, SR 5.1
Ensure strong password policy is implemented and default credentials should not be used, passwords must be changed periodically.	This safeguard will help in prevention of passwords and account takeover attacks.	ATT&CK for ICS: M0927 NIST SP 800-53 Rev5: IA-5 ISA/IEC 62443-3-3: SR 1.7
Conduct back-ups of device-level and system-level information. For IPC102 drives, use Danfoss MCT10 SW to save the project. For Technologic PPS, use the save option in User setup (Service -> File-system) which is saved and loaded with cold starts or after power fails.	The ability of up-to-date backups provides for recovery from control system failures or misconfigurations. This provides systems resilience, including against ransomware.	ATT&CK for ICS: M0953 NIST SP 800-53 Rev5: CP-9 ISA/IEC 62443-3-3: SR 7.3
Implement specific inventory, logging and monitoring of hardware and report security-related incidents to Xylem at product.security@xylem.com. These might include unexpected operations, confirmed tampering, or theft of the device.	Devices are hardened and Xylem provides PSIRT to help customers investigate potential security incidents. This safeguard supports the ability to track assets and recognize potential security events.	ATT&CK for ICS: M0947 NIST SP 800-53 Rev5: SM-8 ISA/IEC 62443-3-3: SR 1.11, SR 2.8, SR 3.4

For additional information see references:

1. ATT&CK for ICS available online: https://collaborate.mitre.org/attackics/index.php/Mitigations
2. NIST SP 800-53 Rev 5 available online: https://nvlpubs.nist.gov/nistpubs/SpecialPublications/NIST.SP.800-53r5.pdf
3. ISA/IEC 62443 standards available for purchase from ISA, IEC, or ANSI.

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CUSTOMER SUPPORT

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