HydroTOUCH®
MULTIPUMP CONTROLLER

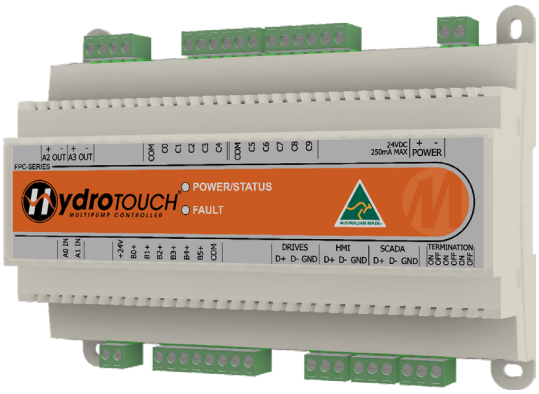
MATelec®
AUSTRALIA

OPERATION MANUAL

HydroTOUCH Pump Controllers - VSD

V3.4

Single Phase - FPC-43X21 (1-12 Pumps)
Three Phase - FPC-43X20 (1-12 Pumps)



HydroTOUCH MULTIPUMP CONTROLLER

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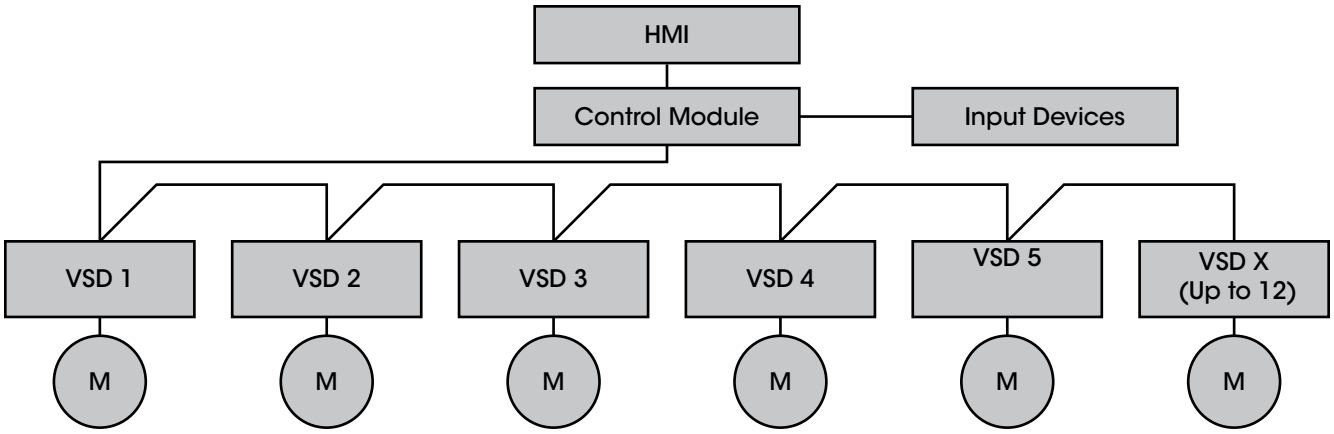
INTRODUCTION

The HydroTOUCH VSD range of pump controllers is an market leading, second generation multi-pump controller designed to operate up to 12 pumps. It features a wide range of advanced control options and a highly flexible array or input and output signals, both digital and analog. Incorporating an easy set-up wizard and a user friendly touch screen, operation of these sophisticated controllers is a breeze! HydroTOUCH VSD controllers have been designed for three different control operations - Pressure, Level, Temperature and Flow, and are highly customisable to suit your specific application.
This Operation Manual applies to the HydroTOUCH VSD (Variable Speed Drives).

OVERALL SOLUTION

Electrically, the HydroTOUCH VSD Controller is comprised of three main components: The control module, the variable speed drives (for 1-6 pumps) and the Human Machine Interface (HMI). The following diagram depicts the basic layout:



SAFETY

This control panel has been designed and built for applications that are Commercial and/or Industrial in nature, operation, function and location. If the control panel is to be used in Domestic/Residential applications, where specific Wiring Rules in respect of 'electrical supply' protection may apply, it is the responsibility of the installing electrician to ensure compliance with relevant standards.

- Prior to installation, ensure power supply is isolated.
- Power supply must be circuit breaker protected (qualified electrician to determine appropriate amp rating).
- It is highly recommended that RCDs are NOT used to protect the supply to this panel. The VSDs in this panel have EMC filtering which can cause nuisance tripping of RCDs. It is recommended to use alternative protection for the incoming cables. If RCDs are required, type B RCDs must be used, taking into consideration the VSD earth leakage current to avoid nuisance tripping.
- Electrical connection to the panel must be carried out in accordance with the following pages.
- Additions or modifications to the control panel are not permitted and will void warranty.
- The controller is not intended for use by children or infirm persons without supervision.
- Repairs to the controller must only be carried out by a suitably qualified electrician.

This manual makes use of the following symbols to indicate warnings that must be paid specific attention to:

Damage to equipment or personal harm may occur if this instruction is not followed

Electrical risk (electrocution hazard) may occur if this instruction is not followed

HARMONIC CONSIDERATION

With all variable speed drives there will be some harmonic distortion on the main power supply. The drives used in the HydroTOUCH VSD have internal filters to reduce the amount of distortion, however in some applications additional filtering may be required. If additional harmonic filtering is required to meet site specifications this can be requested. See below an excerpt from the Australian Standard AS/NZS 61000.3.6 "Limits - Assessment of emission limits for distorting loads in MV and HV power systems":
'Power utility companies and Australian Standards stipulate maximum harmonic levels which apply at a customer's PCC (point of common coupling). Generally, the maximum permissible harmonic levels are given in terms of % THVD however to achieve a reduction in THVD, the customer is required to reduce their THID through the use of harmonic mitigation equipment. Commonly, THVD levels are required to be between 5-8%, however this will vary from state to state. IEEE STD 519 (1992) and AS/NZS 61000.3.6 (2001) are two widely used harmonic limit standards, however other standards may also be relevant including AS/NZS 61000.3.2 2007. Please confirm harmonic requirements with your utility provider. For more information please refer to the relevant standard.'

EMC REQUIREMENTS (ELECTROMAGNETIC COMPATIBILITY)

The EMC requirements depend on the intended use of this controller, and it is the requirement of electrical/electronic equipment to comply with EN/AS 61800-3:2004. This controller incorporates ABB ACS180 Variable Speed Drives as standard which are fitted with an internal EMC C3 Filter. (Other VSD models may be used in the event of supply shortage at the discretion of MATelec Australia).
This VSD C3 filter fits into the Class A Environment of AS61800-3 standards which includes all establishments other than those directly connected to a low voltage power supply network which supplies buildings used for domestic purposes e.g. Industrial areas, or technical areas of any building fed from a dedicated transformer. The ACS180 VSD complies with the EMC C3 Filter standard as long as the cable length to the motor does not exceed 10mtrs length for up to 3kw 230V 1phase and 7.5kw 400V 3phase or 30mtrs length for 11kw to 22kw 400V 3phase. *When the controller is installed in residential areas or directly connected to a low voltage power supply network, supplementary measures may be required to prevent the variable speed drives causing radio interference. Please contact MATelec Australia to discuss this requirement.

FUNCTIONS & FAULT PROTECTION - GENERAL

MULTI PUMP CONTROL

The HydroTOUCH VSD controller can control up to 12 pumps in any number of Duty/Duty assist/Standby configurations. In the Setup Wizard the number of pumps connected is preset by *number of pumps*. The number of duty assist pumps, that is the maximum number of pumps running at one time, is set by *pump limit*.

SYSTEM TYPES & CONTROL DIRECTION

The HydroTOUCH VSD controller has the ability to operate four system types: Level, Pressure, Temperature and Flow control. In each of these system types the controller can operate in either direction; filling or emptying a tank in level mode, raising or lowering pressure in pressure mode, raising or lowering flow rate in flow mode and cooling or heating in temperature mode. This flexibility makes the HydroTOUCH VSD controller suitable for a wide range of applications, including pressurised water supply, water transfer, stormwater and sewerage pump out, process water control, filtration, dosing, hot water circulation and chiller supply, to name a few. The functions and protections specific to each system type are explained on the following pages.

DUTY SHARING & ALTERNATION

The duty pump will alternate after the *duty change period*, which is set to 60 minutes by default, to the pump with the least run hours. When duty alternates, the original duty pump will remain on for 10 seconds while the new duty pump is starting to ensure a bumpless transfer. Duty will also alternate after the system wakes up from sleep, or if a pump is shut down due to a fault.

JACKING PUMP CONTROL

For situations where one pump is smaller than the other pumps to suit various flow rates, the *jacking pump mode* can be enabled in the Setup Wizard. If set to 'DOL', an output can be assigned to control an additional DOL jacking pump. If set to 'VSD', pump 1 will operate as a VSD static lead pump. In either mode, the jacking pump will always be the first to wake from sleep. If the jacking pump cannot keep up with demand one of the main pumps will start and the jacking pump will turn off after 10 seconds, to ensure a smooth transition. When the last main pump's speed falls to the *duty destage threshold speed* and the pump is no longer required, the jacking pump will start and the main pump will switch off after 5 seconds. If the jacking pump is also not required to run the system will go to sleep and await the next wakeup signal.

SYSTEM ENABLE INPUT

In addition to the digital inputs used for pump control and low/high protection, the HydroTOUCH VSD controller features a System Enable input which is used to enable and disable the system in auto mode. This could be controlled by auxiliary sensors from tanks, irrigation systems or BMS systems, for example. The system enable input can be assigned in the parameters list.

MANUAL MODE

A pump can be put in manual when the system mode is in off or auto. To put a pump into manual touch on the pump to access the pump's screen, ensure it is enabled and press the manual toggle to enable manual operation. The pump will run at the *manual speed*. If the system is locked out due to a fault, a pump can still be placed in manual if required to maintain water supply. An override warning screen will appear for the user to confirm if they want to proceed and override system protections. A warning will also appear on the main screen, and a 'System Protect Override' fault will be logged on the alarms page. After 15 minutes of manual running the pump will revert back to auto mode.

BMS & SCADA

The HydroTOUCH VSD controller features up to 10 assignable volt free outputs which may be activated to indicate various system events such as a system fault, pump run or level reached. The controller also features two assignable analog outputs which may be used to remotely monitor system pressure, speed or tank level, for example. These can be configured on the last two pages of the Setup Wizard. For more advanced interface ability, the HydroTOUCH VSD features Serial RS485 connections for communicating with SCADA systems over Modbus RTU protocol, providing full remote monitoring and control of the system. Din rail mount terminals can be provided for these connections on request.

SETPOINT RAMP

Setpoint ramp ensures smooth operation if large feedback errors are seen. If the analog feedback value drops too quickly, the system status will change to setpoint ramp using a virtual *setpoint*. The setpoint ramp function will then slowly increase this virtual *setpoint* to reach the actual *setpoint* to reduce setpoint overshoot when using a responsive PID. The system will then return to the running state using the user specified *setpoint*.

PUMP CYCLE PROTECTION

If the system has a faulty non-return valve or similar fault where it can fail to maintain pressure, a lot of energy can be wasted due to continual pump starting and stopping (cycling). If the system goes to sleep but wakes up within 5 seconds 10 times within an hour, the pump cycle fault will be activated, locking out the system. The system will alarm and shut down the pumps. This protection can be enabled in the setup wizard for the pressure, level and flow control modes. The pump cycle fault can also be set to alarm only in the parameters list, allowing the pumps to continue running.

MAX FLOW PROTECTION

The max flow protection protects the system when the pumps run continuously at maximum speed, as would occur in the event of a burst pipe. If enabled and all available pumps are running at maximum speed for 10 minutes, the max flow fault will be activated, locking out the system. The system will alarm and shut down the pumps. This protection can be enabled in the setup wizard for the pressure, level and flow control modes. The max flow fault can also be set to alarm only in the parameters list, allowing the pumps to continue running.

ANALOG FAULT PROTECTION

If one or both analog inputs are in use and the input drops below 3.5mA or exceeds 20.5mA for 5 seconds, the corresponding A0 or A1 input alarm will be activated. If A0 or A1 is used as a feedback signal and the input fails, the no feedback lockout will be activated, shutting down the pumps. If A0 or A1 is used for an auxiliary function, the alarm can be changed to a lockout fault in the parameters list. If the fault conditions are removed these faults they will automatically reset and the system will resume normal operation.

TRANSDUCER REDUNDANCY

If analog input A0 or A1 is assigned to a backup transducer and the primary transducer fails, the system will switch to the backup transducer and continue operating. If both analog inputs fail, the no feedback fault will be activated, shutting down the pumps. Additionally, if the difference between the primary and secondary analog input values exceeds the *max transducer difference* for 10 seconds, the backup discrepancy fault will be activated. In this event, the analog input used for control will be the highest analog value in pressure, flow, level fill and temperature heat modes, or the lowest analog value in level empty or temperature cool modes.

PUMP VSD PROTECTION

Each pump's variable speed drive has its own built in protections including thermal overload, supply phase loss, under/over voltage and earth fault protection. All of these protections will trigger a pump fault on the HMI screen, after a 2 second delay, and the fault code and description will appear on the Pump screen.

PUMP SHORT CIRCUIT PROTECTION

Each individual pump is protected by its own circuit breaker in the event of an electrical short in the pump or cable. If the supply circuit breaker is sized suitably this will ensure a fault with a single pump and should not disrupt power to the other pumps available.

UV LAMP CONTROL

To ensure high water quality some installations require UV filtering. An output on the HydroTOUCH VSD can be assigned to control UV lamps, switching them off when not required to prolong their lifespan. If the UV supply mode is set to 'Constant', the UV output will be constantly activated. If a mains bypass valve is in use the supply mode can be set to 'Rain water'. The output be switched off when the system is in mains water state and on when in normal pump operation. If set to 'Pump running', the output will switch on only when a pump is running. When the UV lamp is no longer required as per the supply mode, the output will switch off after a 5 second delay. Additionally, up to 2 UV lamp fault inputs can be assigned to provide UV lamp fault protection. If a UV fault input is activated for the fault delay period, the fault will be activated.

FILTER BLOCKED & FILTER FAULT PROTECTION

The HydroTOUCH VSD features the ability to provide 2 filter blocked inputs, which are ideal for use with differential pressure switches monitoring pressure blockage across filters, where an alarm or system shut-down is required. The controller can also provide 2 filter fault inputs to alarm or shut-down the system if auto backwash filters become faulty. The fault modes and other settings for these faults can be configured in the parameters list.

FUNCTIONS & FAULT PROTECTION - PRESSURE CONTROL

SENSOR CONTROL

In the pressure *System type*, the HydroTOUCH VSD is controlled by a 4-20mA pipe mounted pressure transducer, an optional backup pressure transducer, and an optional backup high pressure switch. If the high pressure switch input is not required it must be bridged.

WAKEUP & SLEEP

As the system pressure decreases and the analog feedback value drops 50kPa below the *setpoint*, the duty pump will start, after a 1 second delay. Once the system pressure returns to the analog *setpoint* and there is no more demand for water based on the *no demand speed* the controller will stop the duty pump and go to sleep, after the sleep delay period of 10 seconds.

SLEEP ASSIST

The Sleep Assist function is used to assist the pumps in going to sleep in situations with changing no demand points or where the slip in centrifugal pumps is hard to detect. There are two options within Sleep Assist:
Speed Minimise - When the system is at *setpoint* and pump speed is not varying more than 1.0Hz for 20 seconds, the system will slowly drop the pump speed to try and reach the *no demand speed*, to help the pump go to sleep sooner. If the pressure deviates from the *setpoint* by a certain amount the system will leave speed minimise and return to normal running state.
Boost - When there is no water being used and the system is about to go to sleep, the system *setpoint* is adjusted to '*setpoint + sleep boost pressure increase*' to increase the system pressure before going to sleep. This allows the system to stay in sleep for a longer period of time to reduce pump cycling. If the system can't build the pressure to this new *setpoint* within 5 seconds and the sleep condition is still met, the system will go to sleep anyway. If the pressure drops below the *setpoint* by a certain amount while attempting a sleep boost the system will return to normal running mode.

PID SPEED CONTROL

The Pressure system type uses PID (Proportional, Integral and Derivative) speed control of the pumps to maintain the *setpoint* pressure, adjusting the speed between the *minimum speed* and maximum speed of 50Hz as required. The *proportional* and *integral* values can be adjusted in the setup wizard to alter the acceleration and deceleration of the variable speed drives to suit specific pump sizes and applications.

PUMP STAGING & DESTAGING

Additional pumps will be staged into operation to assist the duty pump if it cannot keep up with demand. When the pump speed reaches 50Hz, and if the analog feedback is a certain amount below *setpoint*, the controller will stage in another pump, after a 5 second delay. The *pump limit* will limit the number of standby pumps that can be used to assist the duty pump, keeping additional pumps available only on a pump fault.
Pumps will be destaged from operation as they are no longer required. When the pump speed falls to the destage threshold, which depends on the *no demand speed*, the controller will destage it from operation, after a 5 second delay.

PIPE FILL

The pipe fill function is used to gently build pipe pressure, and can be configured in the parameters list. If the system wakes from sleep and the pressure is 20% of the pressure sensor range or more below the *setpoint,* the system will run a single duty pump at 36Hz to increase the pressure slowly (this speed changes based on the *No demand speed*). If the pump fails to increase the pressure to less than 20% of the pressure sensor range from the setpoint in 10 minutes a pipe fill fault will lockout the pumps. **Note -** In some continual water demand applications, the pipe fill function should be disabled after initial commissioning, to prevent the pipe fill fail fault from activating during normal operation.

HIGH PRESSURE PROTECTION

The high pressure fault is triggered after the high pressure input opens and/or the analog *high pressure threshold* is reached, if the analog *high pressure protection* is enabled in the setup wizard. The fault is automatically resets 20 seconds after the high pressure input closes and/or the analog value drops below the *high pressure threshold.* The high pressure fault mode is set to 'Lockout' (alarm and pump shut-down) by default, but can also be set to 'Alarm' (alarm only) or 'Inhibit' (pump shut-down only) in the parameters list.

LOW PRESSURE PROTECTION

The low pressure fault is triggered 30 seconds after the analog *low pressure threshold* is reached, if the analog low pressure protection is enabled in the setup wizard. The fault will only activate if the system is in auto mode and a pump is running at a speed above the *No demand speed.* The low pressure fault lockout is enabled by default, so when the fault is activated, the system will be inhibited and the pumps shut down. After 60 seconds the system will restart and attempt to build pressure. If the analog value rises 50kPa above the *low pressure threshold* for 60 seconds, the fault will reset. If the fault fails to reset, however, the system will be inhibited again. After 10 failed restart attempts, a system lockout will be activated, requiring manual reset. The low pressure fault lockout can also be disabled in the parameters list to alarm only and allow the pumps to continue running when the fault is active.

MAINS WATER BYPASS VALVE CONTROL

For systems supplying water from a storage tank, the *mains bypass enable* can be enabled and the output assigned to 'Rain/mains' will control a normally open mains bypass valve, supplying water when the pumping system is out of water, has lost power or is in a fault lockout condition. The valve output is available on request.

MAINS TANK TOP UP VALVE CONTROL

For pressure systems drawing a water supply from a storage tank there can be times when the normal inflow of rain or treated water does not keep up with the demand. If the *mains tank fill enable* is enabled in the setup wizard the output assigned to 'Top up control' will control a normally closed solenoid valve, maintaining a minimum water level in the tank to ensure no loss of supply. The valve open and closed levels are set via the *top up start level* and *top up stop level* respectively. The valve output is available on request.

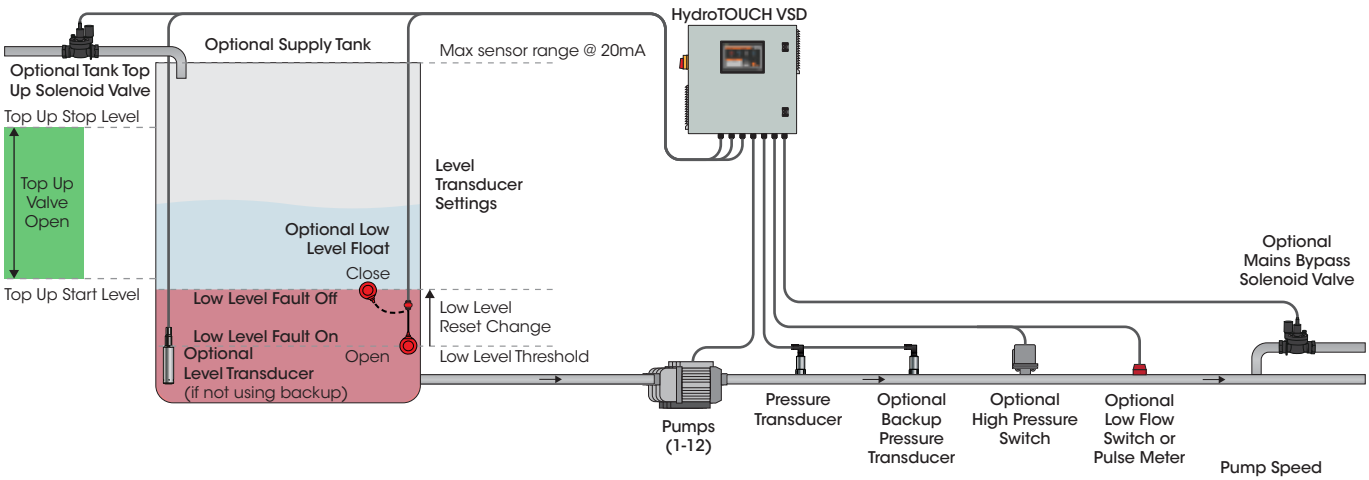
SUPPLY TANK LEVEL MONITORING

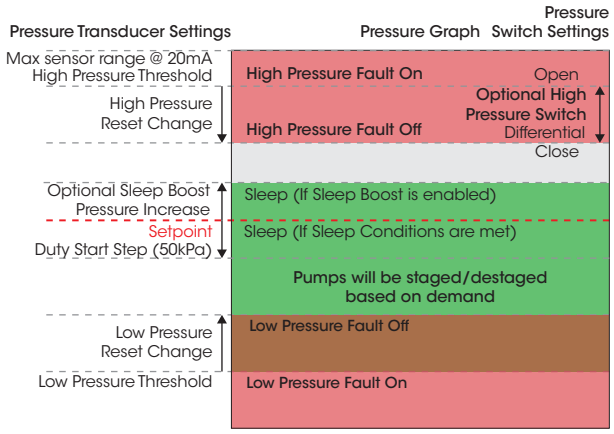
In the Pressure *system type,* the low level input may be used for a low level float switch in a supply tank, shutting down the pumps when this input opens to prevent them from running when there is no water available. Additionally, if the secondary analog input A1 is assigned to 'Tank level' in the setup wizard, instead of using a backup pressure transducer, a level transducer can be used to monitor the level in the supply tank. The analog *Low level protection* can be enabled to alarm and/or shut down the pumps when the level drops below the *low level threshold*.

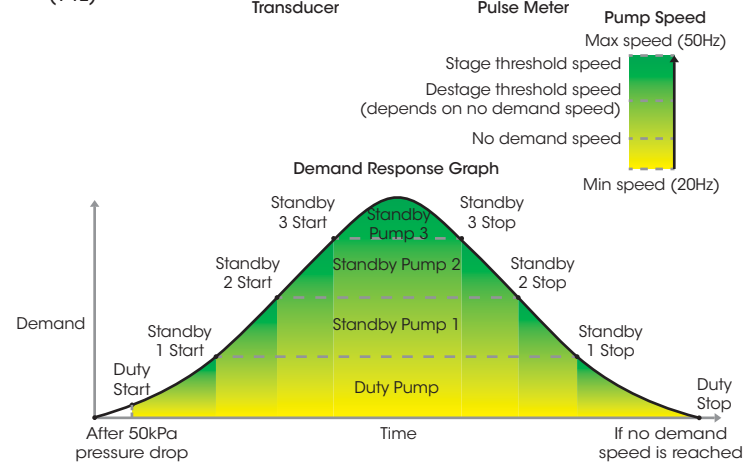
LOW FLOW PROTECTION

A flow switch or pulse meter can be connected to the digital input B5 to provide low flow protection in the pressure *system type*. The low flow fault is triggered 30 seconds after the low flow input (flow switch) opens or the analog flow rate (pulse meter) drops below the *low flow threshold*. The system must be in auto mode and the pump speed must be above the *No demand speed* for the fault to be activated. If the low flow protection is set to 'Alarm only', an alarm only will occur, and the fault will be automatically reset 60 seconds after the low flow input closes and/or the analog value rises above the *low flow threshold*. If set to 'System Lockout' (default), the system will be inhibited and the pumps shut down. If set to 'Pump fault', the running pump will shut down and another pump brought into operation. After 60 seconds, the controller will restart the inhibited pump or system and try to re-establish flow. If flow is achieved for a period of 60 seconds, the alarm will be reset. If the system or pump is unable to achieve flow, however, it will be inhibited again. After 10 consecutive failed restart attempts, a system or pump lockout will occur, requiring manual reset.
Alternatively, if the protection type is set to 'Sleep', the low flow fault will shut down the pumps and the system will sleep. This is ideal for applications that require start on pressure and stop on flow, for example. Care must be taken to ensure the wakeup condition does not remain active otherwise the pumps will cycle on and off continuously.

CONSTANT PRESSURE APPLICATION DIAGRAM







Note: These application diagrams shows the input and output options available for a HydroTOUCH VSD pump controller configured to control 4 pumps (max number of pumps is 12).

FUNCTIONS & FAULT PROTECTION - LEVEL CONTROL

CONTROL DIRECTIONS

In level operation there are two modes, 'fill' and 'empty', which work opposite to one other. 'Empty' will increase the number of pumps running as the level rises to keep a tank empty whereas 'fill' will increase the pumps running as the level falls to try and fill the tank.

SENSOR CONTROL

In the 'Level' *System type*, the HydroTOUCH VSD is controlled by a 4-20mA level transducer, an optional backup level transducer, and an optional backup low level float switch, submerged in a tank or pit. If the low level float switch is not required the input must be bridged. An input can also be assigned in the parameters list for a backup high level float switch, and din rail mount terminals can be provided for this input upon request.

WAKEUP & SLEEP

As the level in the tank rises or falls (depending on the *control direction)* and the analog *duty start step* is reached, the duty pump will start, after a 1 second delay. Once the water level returns to the analog *setpoint*, the controller will stop the duty pump and go to sleep, after the sleep delay period of 10 seconds.

PROPORTIONAL SPEED CONTROL

The level *system type* uses proportional speed control of the pumps to maintain the *setpoint*. The controller will linearly increase the speed from the *minimum speed* when the level is at the *setpoint,* to the maximum speed at the *VSD full speed level*.

PUMP STAGING & DESTAGING

Additional pumps will be staged into operation to assist the duty pump after each analog *standby start step* from the *duty start step* is reached, after a 5 second delay. The *pump limit* will limit the number of standby pumps that can be used to assist the duty pump, keeping additional pumps available only on a pump fault.
Pumps will be destaged as the analog value returns past each analog *standby start step*, after a 5 second delay.

HIGH LEVEL PROTECTION

The high level fault is triggered 5 seconds after the high level input closes, if assigned in the parameters list, and/or the analog *high level threshold* is reached, if the analog *high level protection* is enabled in the setup wizard. The fault automatically resets 3 seconds after the high level input opens and/or the analog value drops 0.1m below the *high level threshold*. The high level fault mode is set to 'Alarm' (alarm only) by default, but can also be set to 'Lockout' (alarm and pump shut-down) or 'Inhibit' (pump shut-down only) in the parameters list.

LOW LEVEL PROTECTION

The low level fault is triggered 3 seconds after the low level input opens and/or the analog *low level threshold* is reached, if the analog *low level protection* is enabled in the setup wizard. The fault will only activate if the system is in auto mode and a pump is running. The fault is automatically reset after the low level input closes and/or the analog value rises 0.1m above the *low level threshold*. The high level fault mode is set to 'Lockout' (alarm and pump shut-down) by default, but can also be set to 'Alarm' (alarm only) or 'Inhibit' (pump shut-down only) in the parameters list.

MEDIUM LEVEL PROTECTION

For applications that require an additional warning level before the high or low level is reached, the HydroTOUCH VSD features medium level protection, which can be enabled in the parameters list. This protection can be activated by a digital input and/or the analog *medium level threshold*. The alarm direction can be set to 'Low' to activate the fault when the digital input closes or the level rises above the *medium level threshold,* or 'High' to activate the fault when the digital input opens or the level drops below the *medium level threshold*. The fault mode can be set to 'Alarm', 'Lockout' or 'Inhibit'.

MAINS TANK TOP UP VALVE CONTROL

For systems requiring a backup water supply in addition to the primary supply, the tank top up function can be used to maintain a minimum water level in the storage tank, ensuring no loss of water supply. If the *mains tank fill enable* is enabled in the setup wizard the output assigned to 'Top up control' will control a normally closed solenoid valve. The valve open and closed levels are set via the *top up start level* and *top up stop level* respectively. The stop level must be set higher than the on level for this function to operate correctly. The valve output is available upon request.

WELL WASH VALVE CONTROL

If the *well wash enable* is enabled in the setup wizard the output assigned to 'Well wash' will control a normally closed well wash solenoid valve. If system has pumped down to *setpoint* and the pumps have stopped, and the time since the last well wash has exceeded 24 hours, the well wash valve will be energised open for 5 minutes. **Note -** The well wash function is unavailable if the *mains tank fill enable* is in use. The valve output is available upon request.

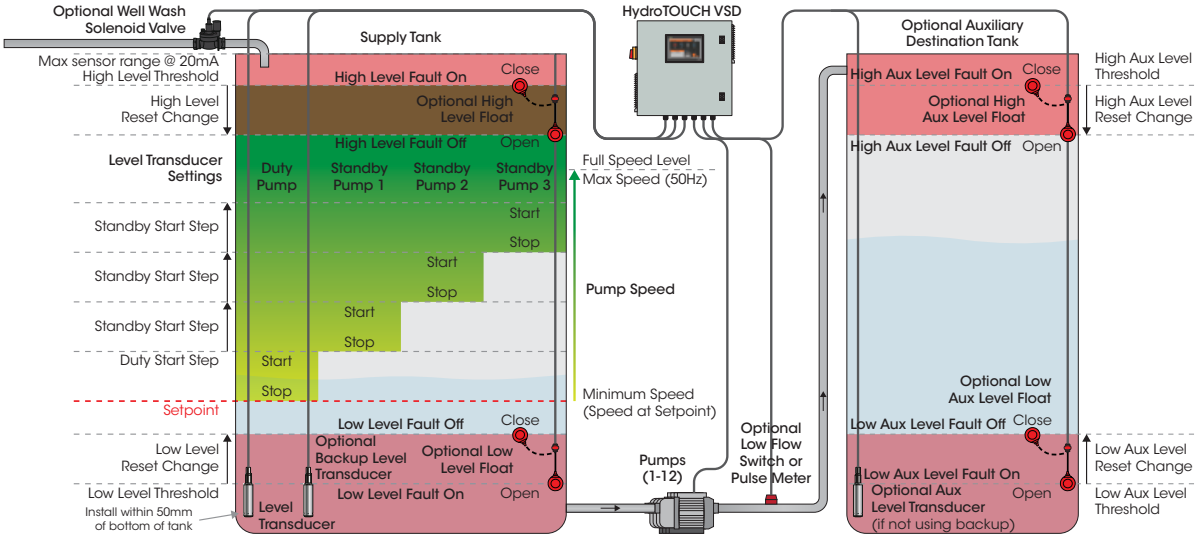
LOW FLOW PROTECTION

A flow switch or pulse meter can be connected to the digital input B5 to provide low flow protection in the level *system type*. The low flow fault is triggered 30 seconds after the low flow input (flow switch) opens or the analog flow rate (pulse meter) drops below the *low flow threshold*. The system must be in auto mode and the pump speed must be above the *No demand speed* for the fault to be activated. If the low flow protection is set to 'Alarm only', an alarm only will occur, and the fault will be automatically reset 60 seconds after the low flow input closes and/or the analog value rises above the *low flow threshold*. If set to 'System Lockout' (default), the system will be inhibited and the pumps shut down. If set to 'Pump fault', the running pump will shut down and another pump brought into operation. After 60 seconds, the controller will restart the inhibited pump or system and try to re-establish flow. If flow is achieved for a period of 60 seconds, the alarm will be reset. If the system or pump is unable to achieve flow, however, it will be inhibited again. After 10 consecutive failed restart attempts, a system or pump lockout will occur, requiring manual reset.
Alternatively, if the protection type is set to 'Sleep', the low flow fault will shut down the pumps and the system will sleep. This is ideal for applications that require start on level and stop on flow, for example. Care must be taken to ensure the wakeup condition does not remain active otherwise the pumps will cycle on and off continuously.

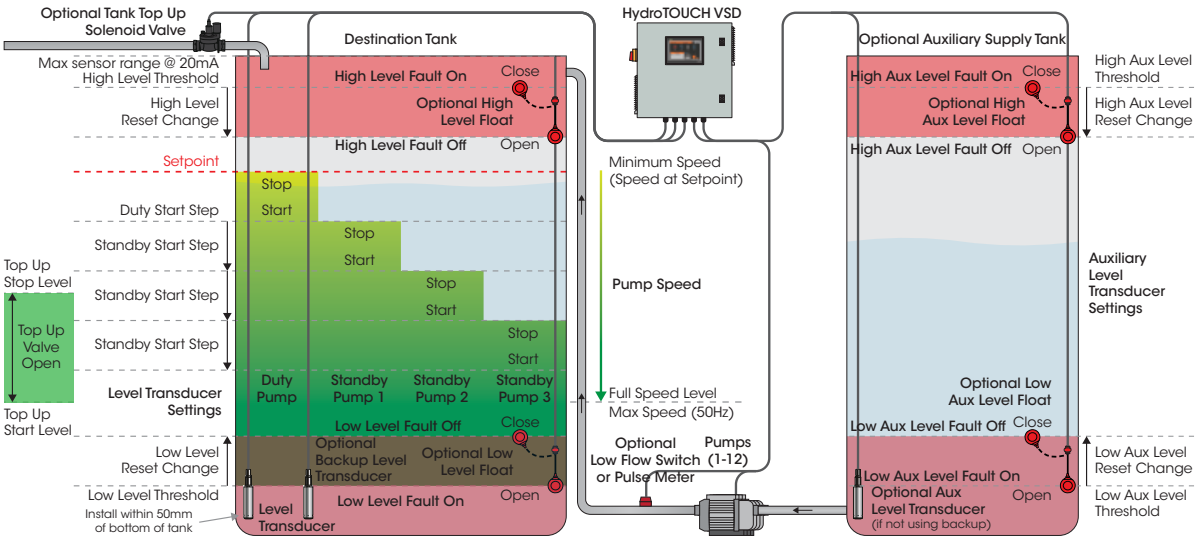
AUXILIARY TANK LEVEL MONITORING

If the secondary analog input A1 is assigned to 'Auxiliary level' in the setup wizard, instead of using a backup level transducer, a level transducer can be used to monitor the level in an additional tank. Auxiliary low and high level protections can be configured in the parameters list to be activated from the auxiliary analog tank level and/or digital inputs. These protections are useful in water transfer applications. For example, the auxiliary high level protection could be used to shut down pumps transferring water from a supply tank to a destination tank, when the destination tank is full.

LEVEL EMPTY APPLICATION DIAGRAM



LEVEL FILL APPLICATION DIAGRAM



Note: These application diagrams shows the input and output options available for a HydroTOUCH VSD pump controller configured to control 4 pumps (max number of pumps is 12).

FUNCTIONS & FAULT PROTECTION - FLOW CONTROL

SENSOR CONTROL

In the flow *System type*, the HydroTOUCH VSD is controlled by a pulse flow meter. Inputs can also be assigned in the parameters list for backup high and low flow switches, and din rail mount terminals can be provided for these inputs upon request.

WAKEUP & SLEEP

In the flow *System type*, sleep is disabled by default, so one pump will always be running to maintain flow, unless shut down due to a fault. In most flow control applications, the low level protection and/or high pressure protection would be used to shut down the pumps, rather than using the sleep function controlled by the analog flow rate.
If sleep is required, however, it can be enabled in the parameters list. When the system is in sleep and the system flow rate falls and the analog feedback value drops 2.5L/s below the *setpoint*, the duty pump will start, after a 1 second delay. If the *Sleep entry mode* is set to 'Setpoint based', once the flow rate returns to the analog *setpoint* the controller will stop the duty pump and go to sleep, after the sleep delay period of 10 seconds. If set to 'Speed based', once the flow rate returns to the analog *setpoint* and there is no more demand for water based on the *no demand speed* the controller will stop the duty pump and go to sleep, after the sleep delay period of 10 seconds.

PID SPEED CONTROL

The flow *system type* uses PID (Proportional, Integral and Derivative) speed control of the pumps to maintain the *setpoint* flow rate, adjusting the speed between the *minimum speed* and maximum speed of 50Hz as required. The *proportional* and *integral* values can be adjusted in the setup wizard to alter the acceleration and deceleration of the variable speed drives to suit specific pump sizes and applications.

PUMP STAGING & DESTAGING

Additional pumps will be staged into operation to assist the duty pump if it cannot keep up with demand. When the pump speed reaches 50Hz, and if the analog feedback is a certain amount below *setpoint*, the controller will stage in another pump, after a 5 second delay. The *pump limit* will limit the number of standby pumps that can be used to assist the duty pump, keeping additional pumps available only on a pump fault.
Pumps will be destaged from operation as they are no longer required. When the pump speed falls to the destage threshold (which depends on the *no demand speed*), the controller will destage it from operation, after a 5 second delay.

HIGH FLOW PROTECTION

The high flow fault is triggered 10 seconds after the high flow input closes, if assigned in the parameters list, and/or the analog *high flow threshold* is reached, if the analog *high flow protection* is enabled in the setup wizard. It automatically resets after the high flow input opens and/or the analog value drops below the *high flow threshold*. The high flow fault mode is set to 'Alarm' (Alarm only) by default, but can also be set to 'Lockout' (alarm and pump shut-down) or 'Inhibit' (pump shut-down only) in the parameters list.

LOW FLOW PROTECTION

The low flow fault is triggered 30 seconds after the low flow input opens and/or the analog *low flow threshold* is reached, if analog *low flow protection* is enabled in the setup wizard. The system must be on and the pump speed must be above the *No demand speed* for the fault to be activated. If the low flow protection is set to 'Alarm', an alarm only will occur. If the low flow protection is set to 'Alarm only', an alarm only will occur, and fault will be automatically reset 60 seconds after the low pressure input closes and/or the analog value rises above the *low flow threshold*. If set to 'System Lockout' (default), the system will be inhibited and the pumps shut down. If set to 'Pump fault', the running pump will shut down and another pump brought into operation. After 60 seconds, the controller will restart the inhibited pump or system and try to re-establish flow. If flow is achieved for a period of 60 seconds, the fault will be reset. If the system is unable to achieve flow, however, it will be inhibited again. After 5 consecutive failed restart attempts, a system lockout will occur, requiring manual reset. The fault mode can also be set to 'Sleep', but this is not recommended in the flow system type, as sleep based on the *setpoint* or the *no demand speed* can be enabled, as explained in the 'Wakeup and Sleep' section above.
Note - The low flow protection is set to 'System Lockout' by default for the flow *system type*. The protection mode can be adjusted in the parameters list if required.

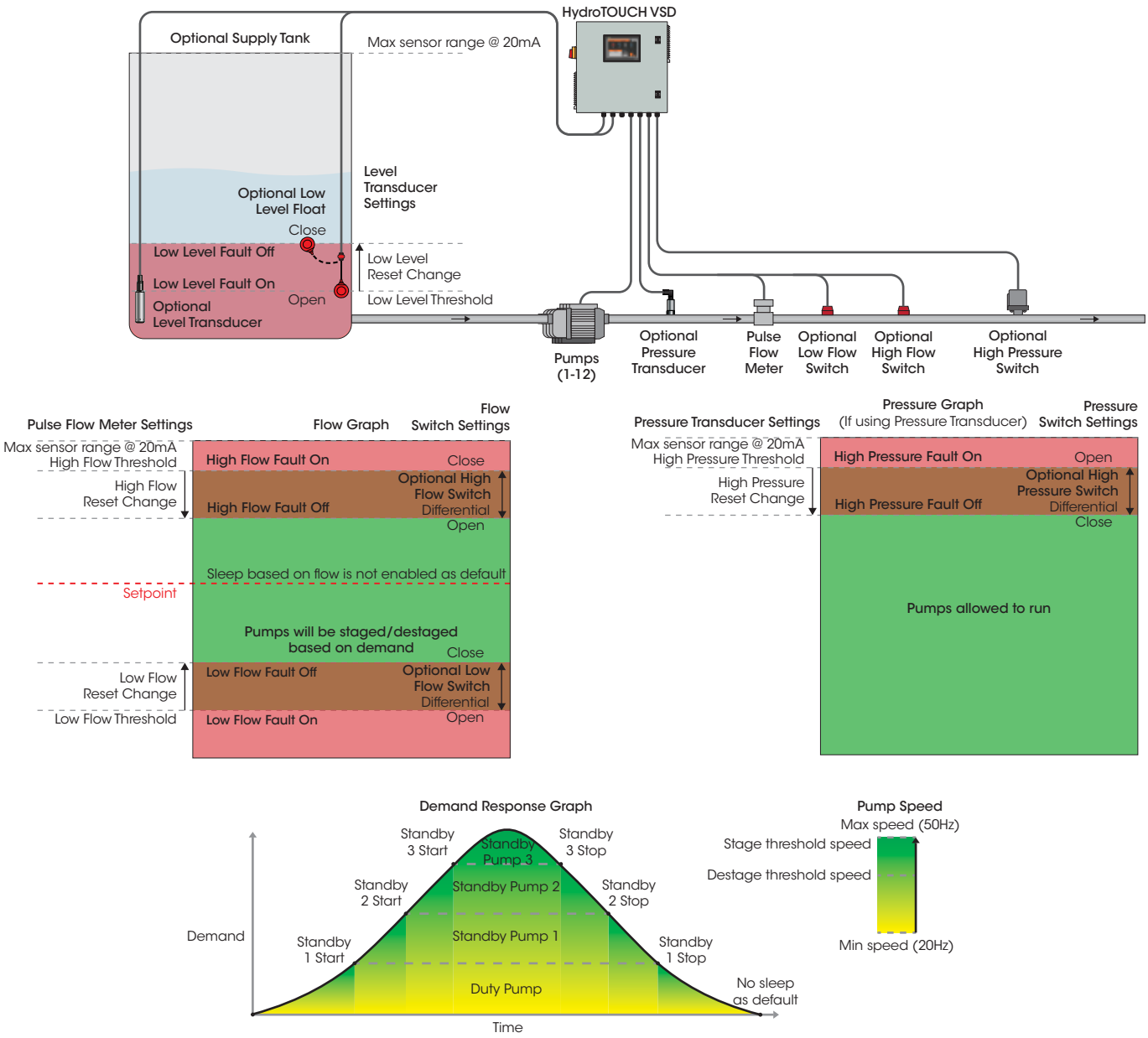
SUPPLY TANK LEVEL MONITORING

In the flow control mode, the low level input may be used for a low level float switch in a supply tank, shutting down the pumps when the input opens to prevent them from running when there is no water available. Additionally, if the *A0 level transducer enable* is enabled in the setup wizard, a level transducer can be used to monitor the level in the supply tank. The analog *Low level protection* can be enabled to alarm and/or shut down the pumps when the level drops below the *low level threshold*.

SYSTEM PRESSURE MONITORING

In the flow control mode, the *A1 pressure transducer enable* can be enabled in the setup wizard to monitor the system pressure, and the high pressure input can be used for a high pressure switch. The high pressure fault is triggered after the high pressure input opens and/or the analog *high pressure threshold* is reached, if the analog *high pressure protection* is enabled in the setup wizard. The fault is automatically resets 20 seconds after the high pressure input closes and/or the analog value drops below the *high pressure threshold*. The high pressure fault mode is set to 'Lockout' (alarm and pump shut-down) by default, but can also be set to 'Alarm' (alarm only) or 'Inhibit' (pump shut-down only) in the parameters list.

FLOW CONTROL APPLICATION DIAGRAM



Note: These application diagrams shows the input and output options available for a HydroTOUCH VSD pump controller configured to control 4 pumps (max number of pumps is 12).

FUNCTIONS & FAULT PROTECTION - TEMPERATURE CONTROL

CONTROL DIRECTIONS

In the Temperature *System type*, there are two modes, 'heat' and 'cool', which work opposite to one other. 'Cool' will start pumps as the temperature rises to maintain a low temperature whereas 'heat' will start pumps as temperature falls to try and maintain a high temperature.

SENSOR CONTROL

In the Temperature *System type*, the HydroTOUCH VSD is controlled by a 4-20mA temperature transducer. Inputs can also be assigned in the parameters list for backup high and low temperature alarm thermostats, and din rail terminals can be provided for these input upon request.

WAKEUP & SLEEP

In the temperature *System type*, sleep is disabled by default, so one pump will always be running to circulate water, unless shut down due to a fault. If sleep is required, however, it can be enabled in the parameters list. When the system is in sleep and the temperature rises/falls by 5°C above/below the *setpoint* (depending on the control direction, 'Heat' or 'Cool'), the duty pump will start, after a 1 second delay. If the *Sleep entry mode* is set to 'Setpoint based', once the temperature returns to the analog *setpoint* the controller will stop the duty pump and go to sleep, after the sleep delay period of 10 seconds. If set to 'Speed based', once the temperature returns to the analog *setpoint* and there is no more demand for water based on the *no demand speed* the controller will stop the duty pump and go to sleep, after the sleep delay period of 10 seconds.

PID SPEED CONTROL

The temperature *system type* uses PID (Proportional, Integral and Derivative) speed control of the pumps to maintain the *setpoint* temperature, adjusting the speed between the *minimum speed* and maximum speed of 50Hz as required. The *proportional* and *integral* values can be adjusted in the setup wizard to alter the acceleration and deceleration of the variable speed drives to suit specific pump sizes and applications.

PUMP STAGING & DESTAGING

Additional pumps will be staged into operation to assist the duty pump if it cannot keep up with demand. When the pump speed reaches 50Hz, and if the analog feedback distance from *setpoint* exceeds a certain amount, the controller will stage in another pump, after a 5 second delay. The *pump limit* will limit the number of standby pumps that can be used to assist the duty pump, keeping some pumps available only on a pump fault.
Pumps will be destaged from operation as they are no longer required. When the pump speed falls to the destage threshold (which depends on the *no demand speed*), the controller will destage it from operation, after a 5 second delay.

HIGH TEMPERATURE PROTECTION

The high temperature fault is triggered 3 seconds after the high temperature input closes, if assigned in the parameters list, and/or the analog *high temperature threshold* is reached, if the analog *high temperature protection* is enabled in the setup wizard. The fault automatically resets 3 seconds after the high temperature input opens and/or the analog value drops 2.0°C above/below (depending on the control direction) the *high temperature threshold*. This protection is set to 'Alarm' (alarm only) by default, but can also be set to 'Lockout' (alarm and pump shut-down) or 'Inhibit' (pump shut-down only) in the parameters list.

LOW TEMPERATURE PROTECTION

The low temperature fault is triggered 10 seconds after the low temperature input opens, if assigned in the parameters list, and/or the analog *low temperature threshold* is reached, if the analog *low temperature protection* is enabled in the setup wizard. The fault will only activate if the system is in auto mode and a pump is running. The fault is automatically reset after the low temperature input closes and/or the analog value rises above the *low temperature threshold*. This protection is set to 'Alarm' (alarm only) by default, but can also be set to 'Lockout' (alarm and pump shut-down) or 'Inhibit' (pump shut-down only) in the parameters list.

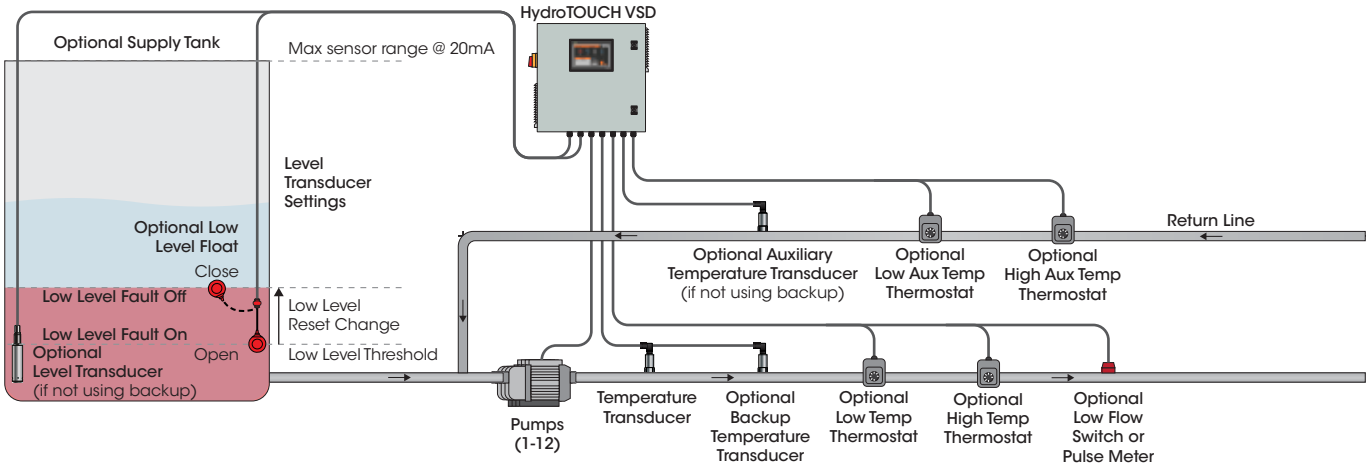
SUPPLY TANK LEVEL MONITORING

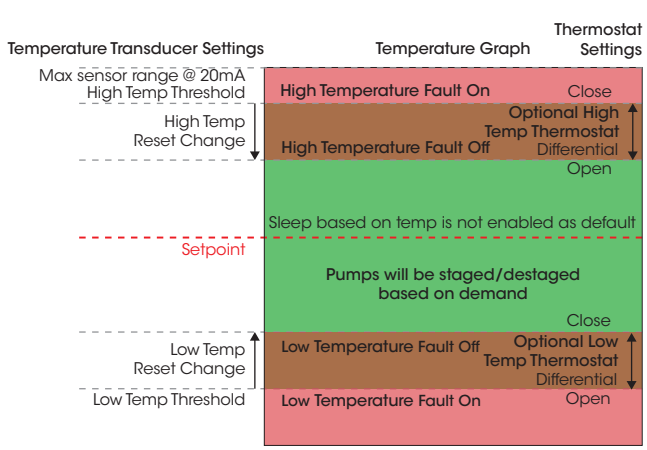
In the temperature mode, the low level input may be used for a low level float switch in a supply tank, shutting down the pumps when the input opens to prevent them from running when there is no water available. Additionally, if the secondary analog input A1 is assigned to 'Tank level' in the setup wizard, instead of using a backup temperature transducer, a level transducer can be used to monitor the level in the supply tank. The analog *Low level protection* can be enabled to shut down the pumps when the level drops below the *low level threshold*.

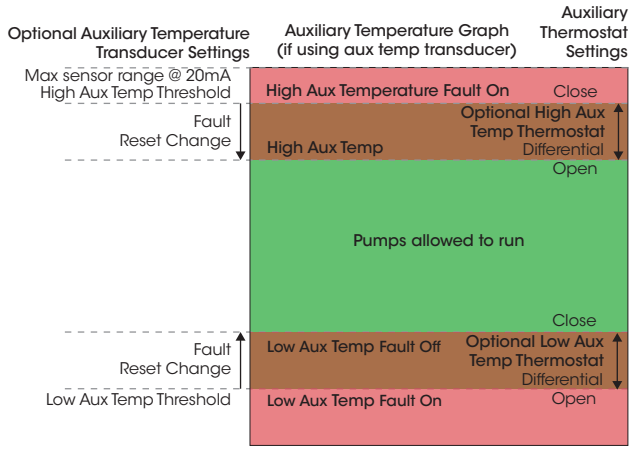
AUXILIARY TEMPERATURE MONITORING

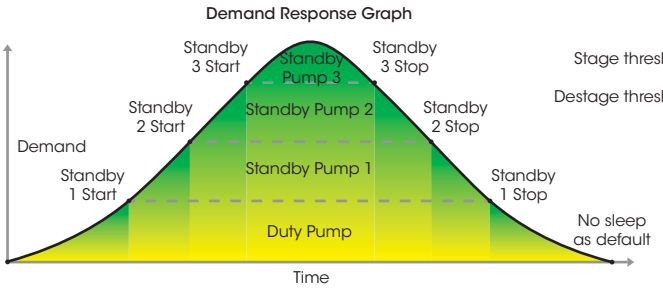
If the secondary analog input A1 is assigned to 'Aux. Temperature' in the setup wizard, instead of using a backup temperature transducer, an additional temperature sensor may be used to monitor the system temperature. This could be used on the return line for recirculation applications. The *high auxiliary temperature alarm* and *low auxiliary temperature alarm* can be enabled to provide additional high and low temperature protection based off the auxiliary analog value. Digital inputs can also be assigned to provide auxiliary high and low temperature protection in the parameters list.

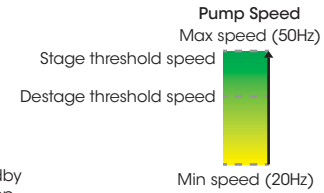
TEMPERATURE HEAT APPLICATION DIAGRAM







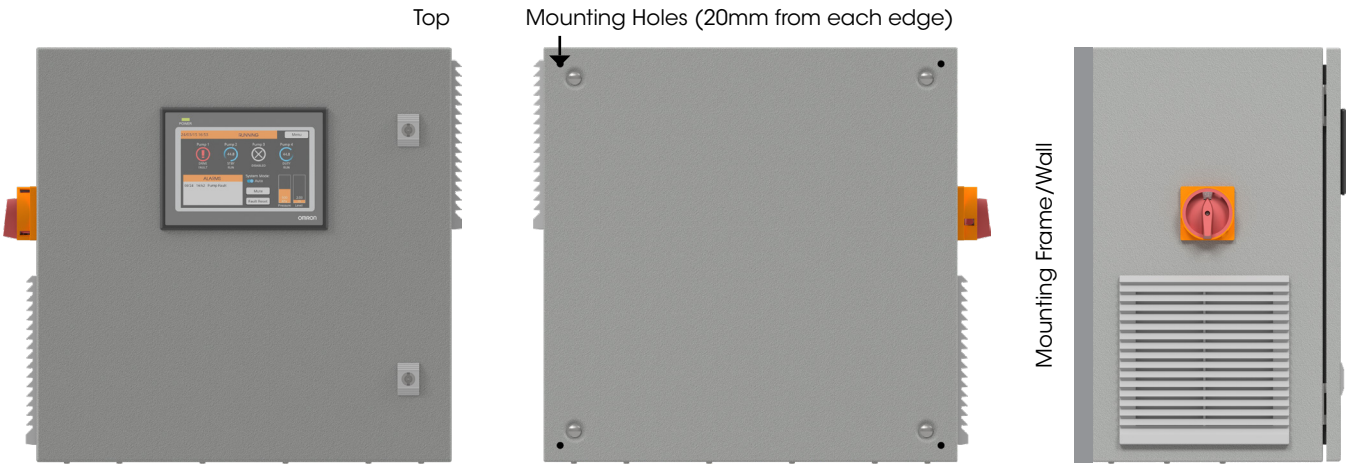




Note: These application diagrams shows the input and output options available for a HydroTOUCH VSD pump controller configured to control 4 pumps (max number of pumps is 12).

INSTALLATION

- Controller enclosure must be mounted in a vertical position.
- Ensure mounting method does not compromise enclosure weatherproof rating.
- Ensure access to main isolator is not restricted.
- Ensure cables/conduits entering the panel have mechanical protection and that the penetrations are sealed and do not compromise the weatherproof rating of the enclosure.

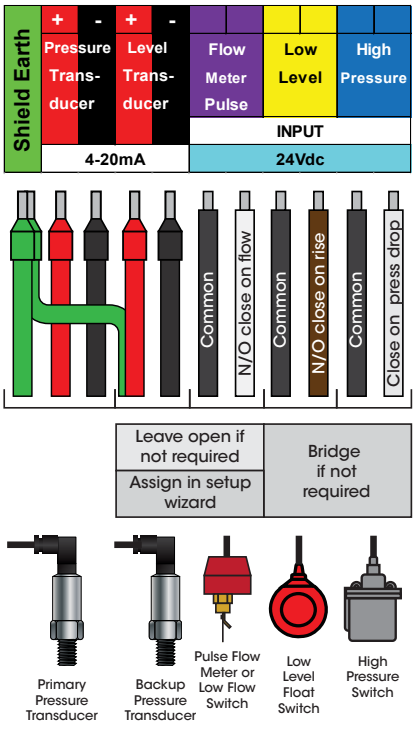


CONNECTIONS

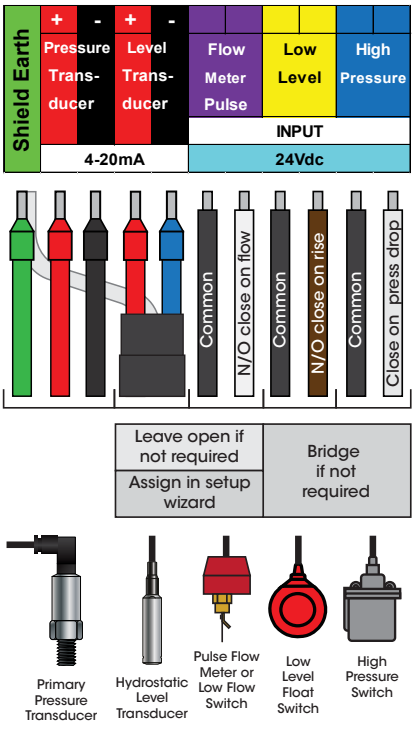
Warning: All electrical connections must be carried out by a suitably qualified and registered electrician

PRESSURE CONTROL CONNECTIONS

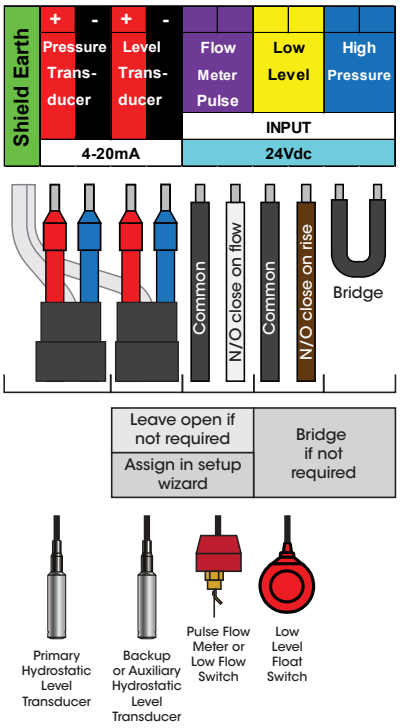
With Backup Pressure Transducer



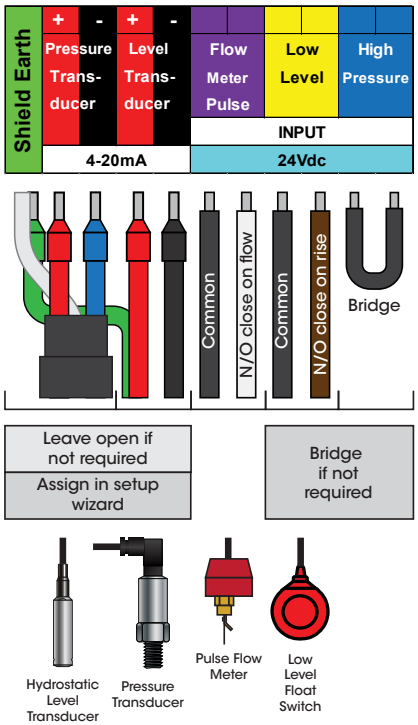
With Tank Level Transducer



LEVEL CONTROL CONNECTIONS

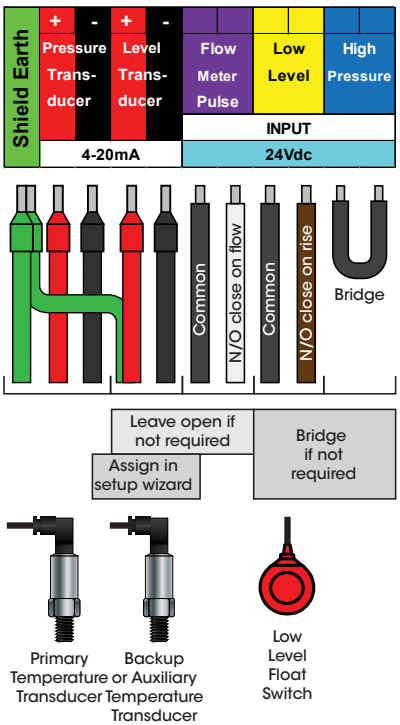


FLOW CONTROL CONNECTIONS

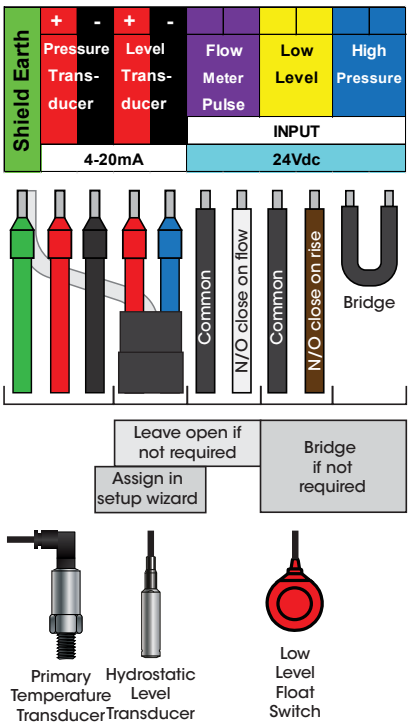


TEMPERATURE CONTROL CONNECTIONS

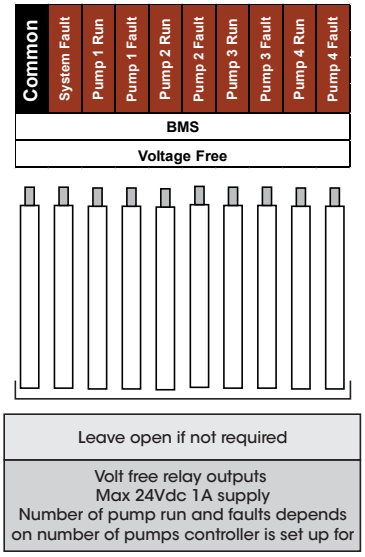
With Backup or Aux Temperature Transducer



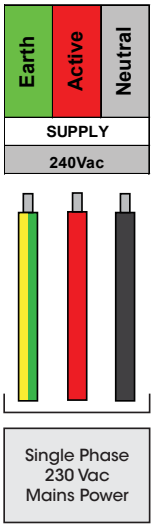
With Tank Level Transducer



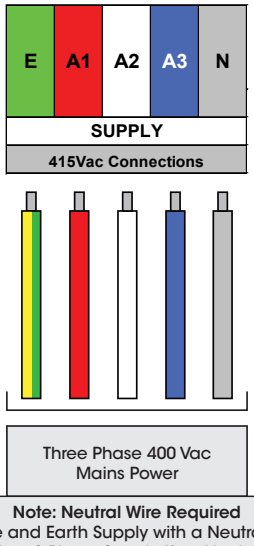
VF CONNECTIONS



1 PHASE POWER SUPPLY



3 PHASE POWER SUPPLY



Note: Neutral Wire Required
A 4 Core and Earth Supply with a Neutral Wire is required on 3 Phase Supply. If no Neutral Wire is available, a customised panel can be supplied.

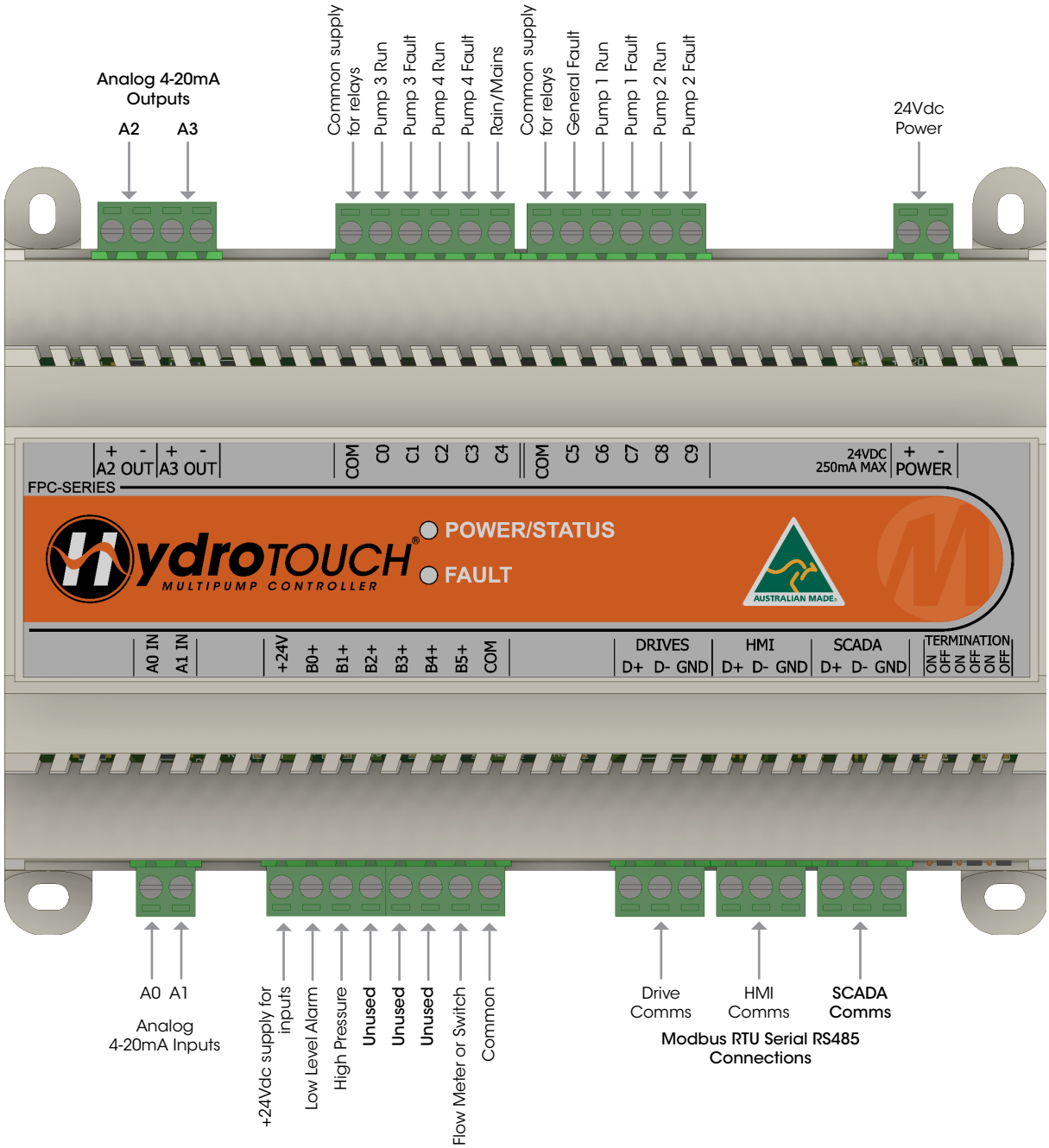
It is highly recommended that RCDs are not used to protect the supply to this panel. Please refer to the Safety section in for more information.

Note:

- These connections show the standard din rail mount terminal connections included in the HydroTOUCH VSD Controller. Additional or customised connections can be provided on request.
- Additional connections are available on the HydroTOUCH VSD Control module, including:
  - 3x Additional digital inputs. These can be assigned as required in the parameters list.
  - Mains bypass, tank top up or well wash valve, UV supply, DOL jacking run or other relay outputs
  - 2x Analog 4-20mA outputs
  - Modbus RTU Serial RS485 connections for SCADA

  Din rail mount terminals can be requested for these connections when ordering, or some can be wired directly to the module. See 'Control Module Connections' on page 17 for more information.

CONTROL MODULE CONNECTIONS



Note:

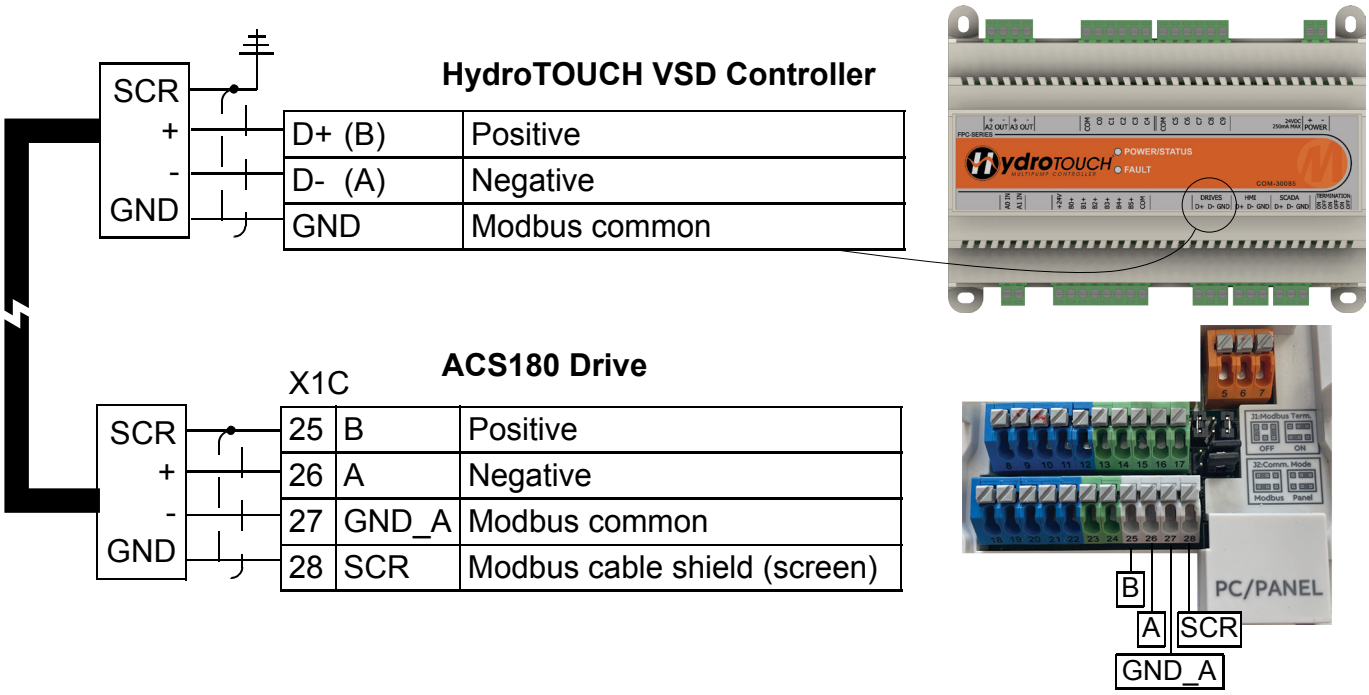
- The connections labelled in bold text are connections that do not have din rail mount terminals as standard. If these are required, they can be wired directly to the module, or additional din rail mount terminals provided as request.
- The digital inputs and relay outputs may differ based on the number of pumps or customer request. See the controller's circuit diagram for specific connections.
- If the controller's parameters are factory reset on the diagnostics HMI screen, the control module's inputs and outputs will reset back to the default and will need to be reassigned as required in the parameters list. See 'Parameters' on page 35 for information on the operation of the Parameters screen.

DRIVE COMMUNICATION

The HydroTOUCH VSD controller uses Modbus RS485 protocol to communicate with up to 12 variable speed drives. Communication to the drives is already set up when the panel is manufactured. If any variable speed drives need to be changed or replaced, however, the drive communication will need to be re-configured. The HydroTOUCH VSD controller is compatible with specific drive models, which are pre-configured by the Drive model setting in the parameters list.

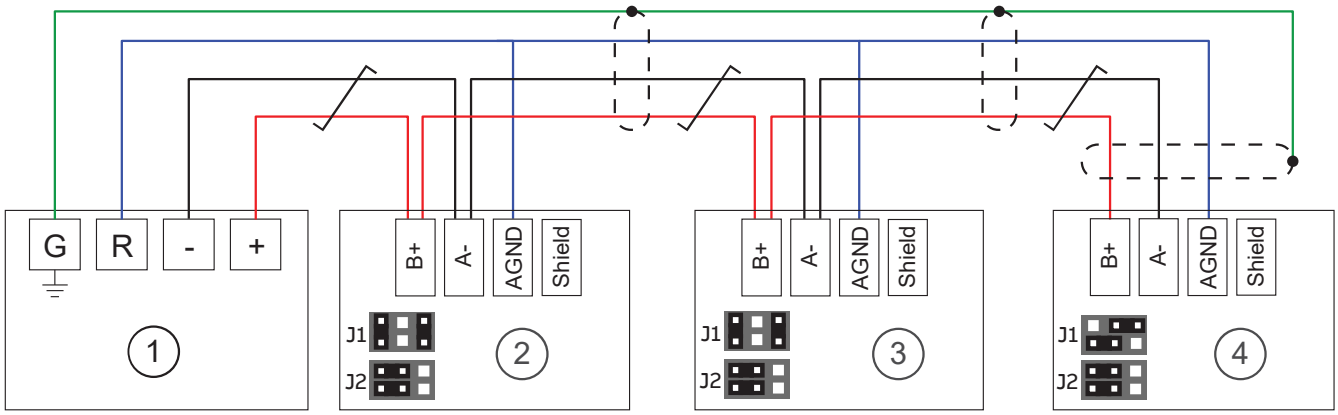
ABB ACS180 DRIVES

Modbus Connections



Termination Resistors

Drives - Each drive in the chain must have Jumper 2 enabled for modbus communication. The final drive in the chain must have Jumper 1 enabled as shown in the figure below.



Adjust Drive Parameters

Power up the drives and put the first drive into LOC (local control), by pressing the back button and pushing OK when 'LOC REM' is highlighted. To access the parameters, press the enter button and scroll till you see '**figure 1**' on screen. Press enter, then push enter when '**figure 2**' is highlighted. Proceed to navigate through and set parameters.

Figure 1

Figure 2

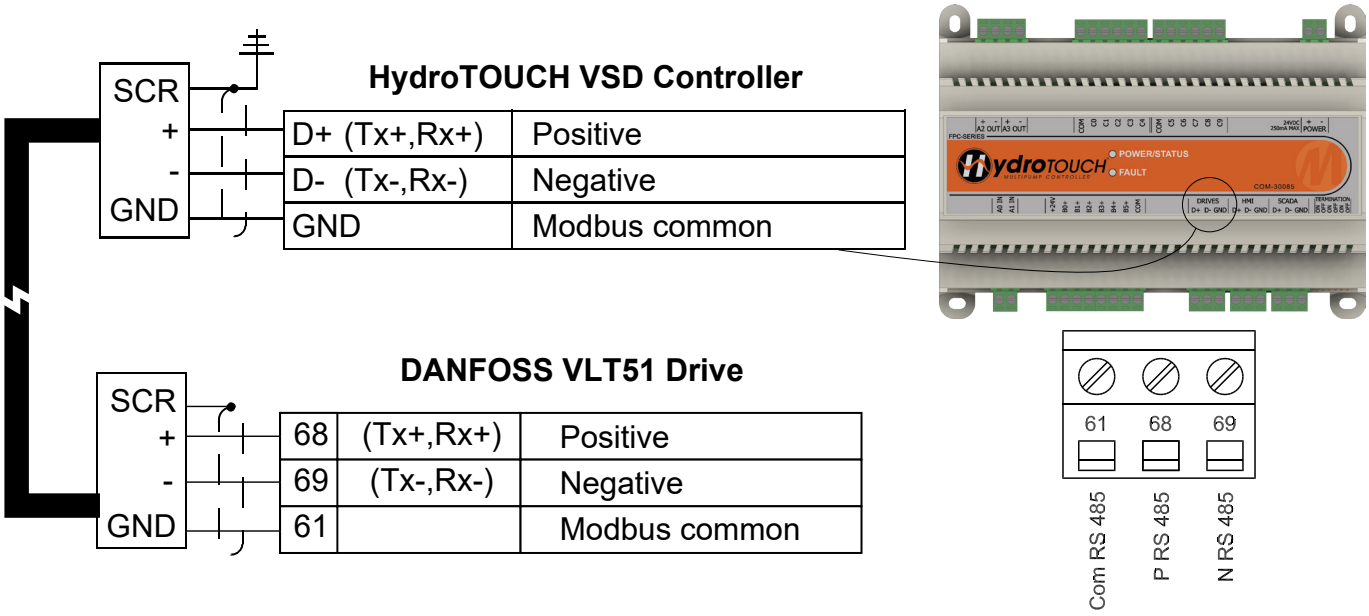
ABB ACS180 DRIVES CONT.

Adjust Drive Parameters cont.

Address	Parameter	Value	Comment
20:01	Ext1 commands	Embedded fieldbus	Code=14
22:11	Ext1 speed ref1	EFB ref1	Code=8
28:11	Ext1 frequency ref1	EFB ref1	Code=8
31:01	External event 1 source	DI1	Code=3
31:13	Selectable fault	#6681	Code=6681
31:14	Number of trials	#5	Code=5
31:16	Total trials time	#15	Code=15
31:24	Stall function	Fault	Code=2
31:27	Stall frequency limit	30Hz	Code=30
46:05	Current scaling	#1000	Code=1000
58:01	Protocol enable	Modbus RTU	Code=1
58:03	Node address	#1	Code=1
58:04	Baud rate	57.6kbps	Code=5
58:05	Parity	8 NONE 1	Code=0
58:14	Communication loss action	Fault	Code=1
58:15	Communication loss mode	Cw/Ref1/Ref2	Code=2
58:16	Communication loss time	#15	Code=15
58:25	Control profile	DCU Profile	Code=5
58:26	EFB ref1 type	Frequency	Code=5
58:29	EFB act2 type	Transparent	Code=1
58:105	Data I/O 5	4.11(16)	Code=4.11(16)
58:106	Data I/O 6	1.6(16)	Code=1.6(16)
58:107	Data I/O 7	1.13(16)	Code=1.13(16)
58:108	Data I/O 8	1.7(16)	Code=1.7(16)
58:109	Data I/O 9	1.14(16)	Code=1.14(16)

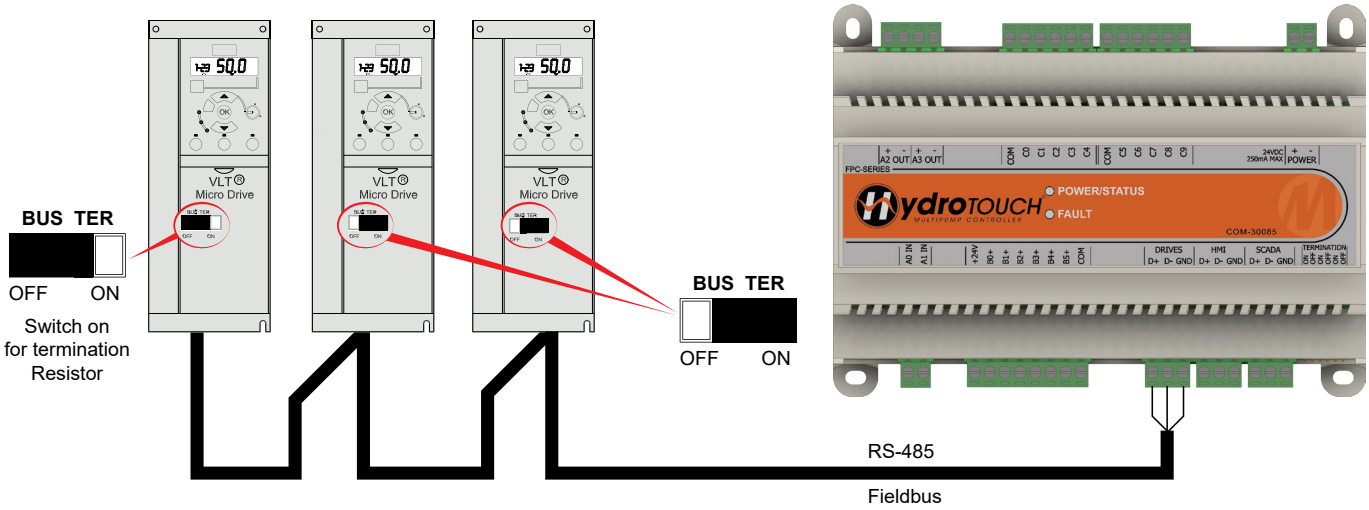
DANFOSS VLT51 DRIVES

Modbus Connections



Termination Resistors

Drives - The final drive in the chain must have a line termination resistor enabled or fitted. Terminate the RS-485 bus with a 120 ohm resistor at the end of the network by setting the switch 'BUS TER' to on.
HydroTOUCH VSD module - The termination resistor for the 'Drives' RS-485 port on the HydroTOUCH must be enabled using the corresponding jumper. The controller 'Drives' RS-485 port contains inbuilt polarisation resistors that are always enabled so no other polarisation resistors are to be fitted.



DANFOSS VLT51 DRIVES CONT.

Adjust Drive Parameters

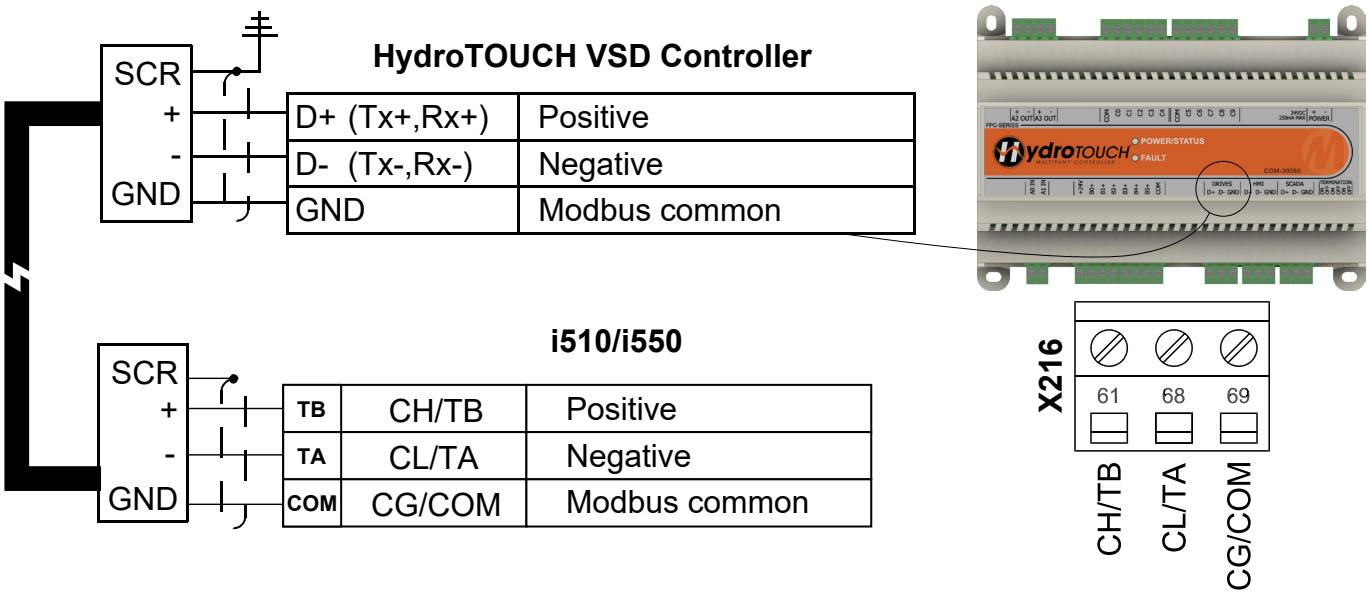
Power up the drives and disable the first drive by pressing the 'Off Reset' button. To access the parameters, press 'Menu', scroll to the parameter and press 'OK' to adjust. Use the arrow buttons to adjust the value the press 'OK' to save. See the table below.

Address	Parameter	Value
8-30	Protocol	2 = Modbus RTU
8-31	Address	1 (Change Modbus address for each drive)
8-32	FC Port Baud Rate	4 = 38400 Buad
8-33	FC Port Parity	2 = 8 None 1
8-03	Comms Timeout	5 = 5 Seconds
8-04	Comms Timeout Action	2 = Stop
8-33	FC Port Parity	2 = 8 None 1
1-01	Motor Control	0 = U/F Control
1-90	Motor Therm Trip	2
1-93	Therm Trip Input	6 = Digital Input
3-00	Reference Range	0 = +Min to +Max
3-02	Minimum Reference	0.00
3-03	Maximum Reference	50.00
3-10	Present Reference 0	0.00
3-14	Present Relative Reference	0.00
3-15	Reference Source 1	0 = Disabled
3-16	Reference Source 2	0 = Disabled
3-17	Reference Source 3	11 = Local Bus Reference
3-18	Relative Scaling Reference Source	0 = Disabled
3-41	Acceleration	1 = 1 Second or 5 Seconds for larger drives
3-42	Deceleration	1 = 1 Second or 5 Seconds for larger drives
4-12	Motor Speed Low Limit	0.0Hz
4-14	Motor Speed High Limit	65.0Hz (Default value)

Once the parameters in the first drive have been adjusted, they can be copied to the other drives. Press 'Menu' to return to the main screen. Then press the 'Menu' button twice until '0-' is displayed and press 'OK', then press the down arrow until '0-50' is displayed and press 'OK'. Scroll up or down until '1' (upload) is displayed and press 'OK' to upload the parameters to the VSD screen. The upload progress will display. Once complete, press the 'Auto On' button to put the drive back into auto mode. The VSD screen can now be removed and placed on the next drive. Press 'Off Reset' to disable this drive, then press 'OK' twice until '0-' is displayed and press 'OK'. Scroll down until '0-50' is displayed, press 'OK', then scroll up or down until '2' (download all) is displayed and press 'OK'. The download progress will display. Once complete, press 'Menu' to return to the main screen. Press 'Menu' again and adjust the 'Address' parameter 8-31. Each drive needs to have an individual address from 1 to 12 that corresponds to the pump number. The drive can then be placed back into auto mode by pressing the 'Auto On' button, and the process repeated for all drives. Once the parameters have been adjusted in all the drives, cycle power to the drives.

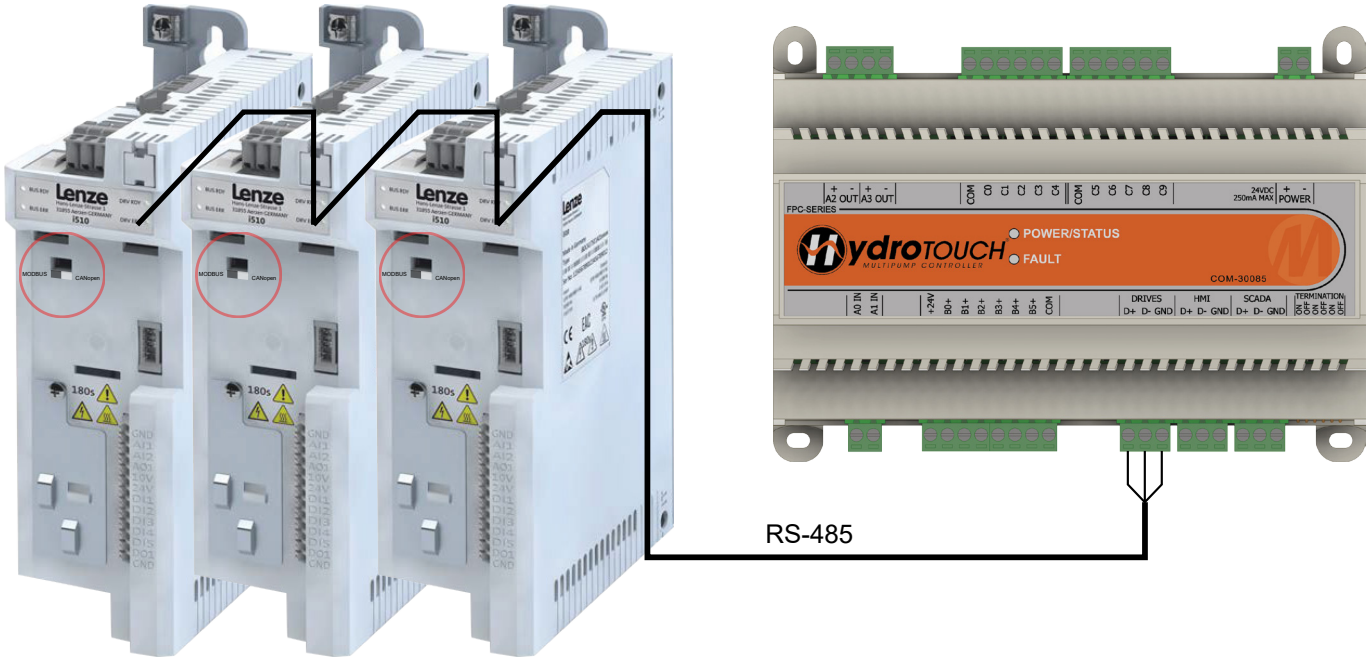
LENZE I510/I550 DRIVES

Modbus Connections



Setting Modbus Communication

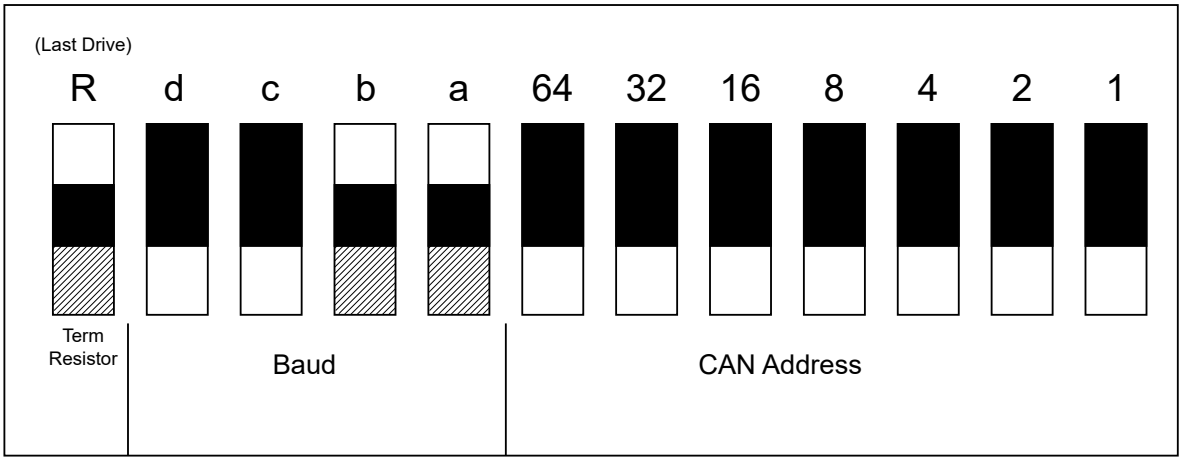
To enable Modbus communication the Modbus/CANopen selector switch with is located behind the user interface must be set to 'Modbus'.



LENZE I510/I550 DRIVES CONT.

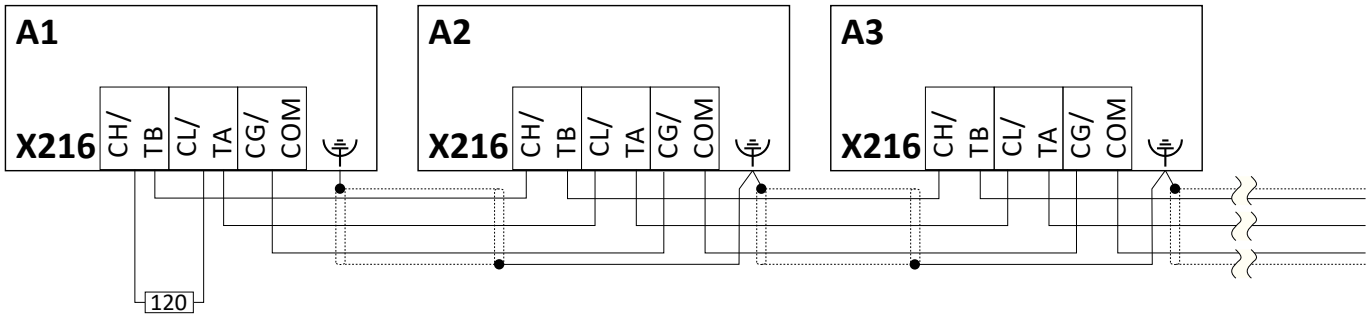
Set mode DIP switches (Lenze i550)

To set fixed baud rate and parity dip switch 'a' and 'b' must be set to on. The HydroTOUCH is set to default baud = 57, 600 and parity 8 None 1. This is to be set on all drives. For the last drive in the chain, dip switch 'R' must be set on to enable the termination resistor.



Termination Resistor (Lenze i510)

Drives - The final drive in the chain must have a line termination resistor enabled or fitted. A 120 ohm resistor is to be wired as follows on the last drive in the chain.
HydroTOUCH VSD Module - The termination resistor for the 'Drives' RS-485 port on the HydroTOUCH must be enabled using the corresponding jumper. The controller 'Drives' RS-485 port contains inbuilt polarisation resistors that are always enabled so no other polarisation resistors are to be fitted.



LENZE I510/I550 DRIVES CONT.

Adjust Drive Parameters

Power up the drives. To access the parameters, press 'enter'. Scroll to the parameter ground and press 'enter' to select. Scroll to the parameter and press 'enter' to adjust. Use the arrow buttons to adjust the value, then press 'enter'. Then hold down the 'enter' button until the parameter is saved. Each drive needs to have an individual address from 1 to 12 that corresponds to the pump number. This is set via parameter P510:001.

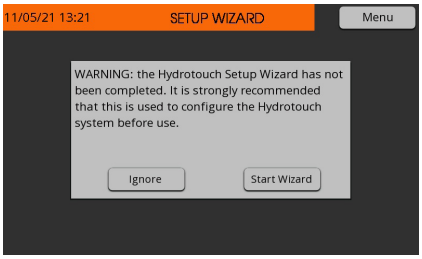
Address	Parameter	Value
P510:001	Modbus settings : Node ID	1
P510:002	Modbus settings : Baud Rate	57600 (6)
P510:003	Modbus settings : Data formate	8 N 1 (4)
P530:001	Modbus parameter mapping : Parameter 1	1074462976
P530:002	Modbus parameter mapping : Parameter 2	1074466048
P530:003	Modbus parameter mapping : Parameter 3	1074528512
P530:004	Modbus parameter mapping : Parameter 4	1074529024
P530:005	Modbus parameter mapping : Parameter 5	1614741504
P530:006	Modbus parameter mapping : Parameter 6	763953152
P530:007	Modbus parameter mapping : Parameter 7	763887616
P530:008	Modbus parameter mapping : Parameter 8	765591808
P530:009	Modbus parameter mapping : Parameter 9	1618280448
P530:010	Modbus parameter mapping : Parameter 10	738264832
P530:011	Modbus parameter mapping : Parameter 11	738264320
P530:012	Modbus parameter mapping : Parameter 12	539099904
P530:013	Modbus parameter mapping : Parameter 13	689307648
P706:001	Break energy management : Operating mode	Inv. m.brake (IMB)+RFGS [3]
P706:003	Break energy management : Reduced threshold	3 Phase = 25V 1 Phase = 10V
P706:004	Break energy management : Additional Frequency	1Hz
P400:002	Function List : Run	Constant TRUE (1)
P400:037	Function List : Activate network control	Constant TRUE (1)
P400:043	Function List : Actiavate Fault 1	DI3
P760:004	Fault Configuraiton : Trouble counter reset time	10s
P515:001	Modbus montitoring: Response to time-out	Trouble (2)
P201:001	Frequency control : Default setpoint source	Network (5)
P315:001	Slip compensation : Gain	0ms
P320:004	Motor parameters : rated speed	2920
P320:007	Motor parameters : Rated voltage	3Phase = 415Vac 1Phase = 240Vac
P306:001	Inverter load charcteristic : Duty selection	Light duty (1)
P350:002	Overspeed monitorig : Response	Warning (1)

Once the parameters have been adjusted on the first drive, the screen can be removed and placed on the other drives so their parameters can be adjusted. Once the parameters have been adjusted in all the drives, cycle power to the drives.

SETUP

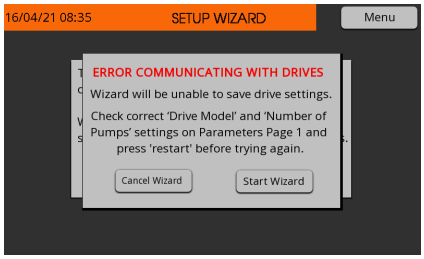
INITIAL POWERUP WARNING

The following screen will appear when the HydroTOUCH VSD is powered up for the first time, or after a factory reset. Press 'Start Wizard' to start the setup process. Login is required to access the Wizard. See 'Login' on page 45 for the login.



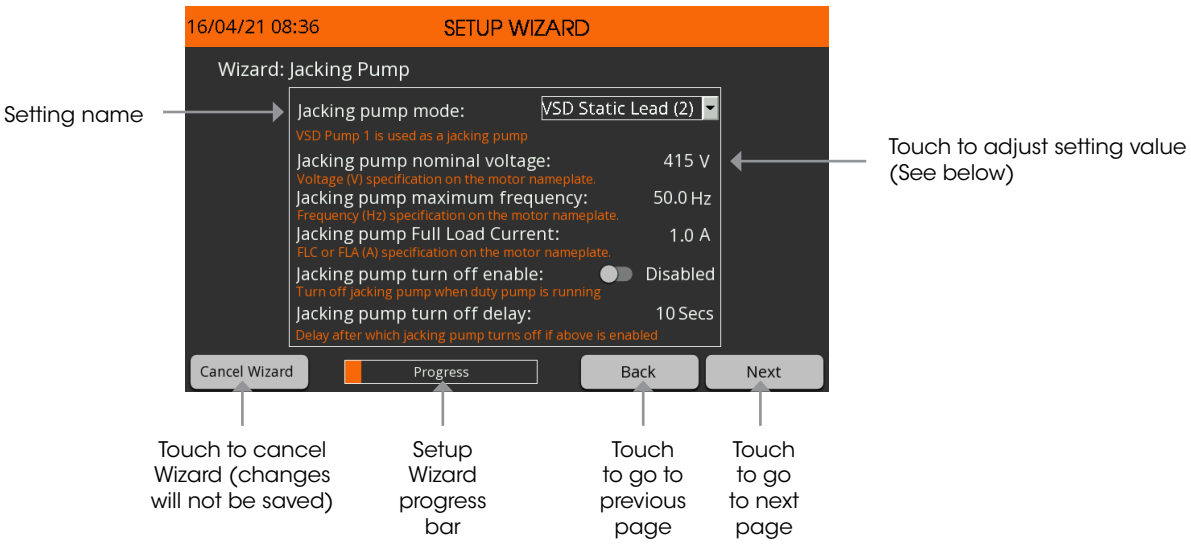
RUNNING THE WIZARD AFTER FACTORY RESET

After a factory reset, the *Drive model* and *Number of pumps* must be reset on page 1 of the parameters list, before the Wizard can be run. See 'Parameters' on page 42 for information on the operation of the parameters screen.



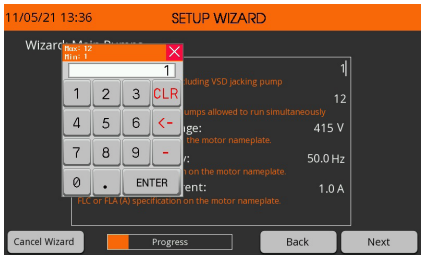
SETUP WIZARD OPERATION

The Setup Wizard is where the controller is configured for operation. Some settings will have been factory set, such as the number of pumps, and will not need to be adjusted. If any settings need to be adjusted after operation has begun, the Setup Wizard can be accessed from the Main screen by tapping on the menu in the top-right corner then tap the on Setup Wizard. Login is required to access this screen. For the login see 'Login' on page 45.



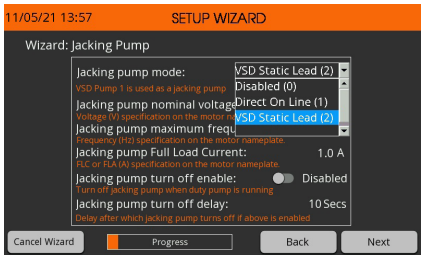
Setting Adjustment - Value

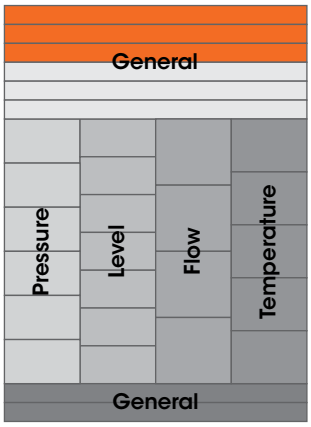
If a value setting, such as *Jacking pump turn off delay*, is pressed on, the keyboard screen will appear and the desired value can be entered or the process cancelled.



Setting Adjustment - Selection

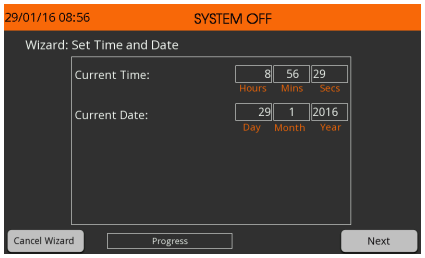
If a selection setting, such as *Jacking pump mode*, is pressed on, a drop down list of all the available options for the setting will appear and the desired option can be selected.





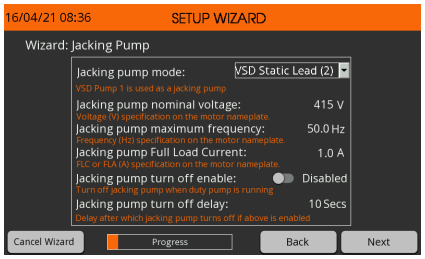
1 - SET TIME AND DATE

Enter the current time and date.



2 - JACKING PUMP

The Setup Wizard page for configuring the DOL or VSD jacking pump, if required. The required settings will display depending on the selection. If no jacking pump is required, set to 'Disabled' and move to the next Wizard page to configure the main pumps.

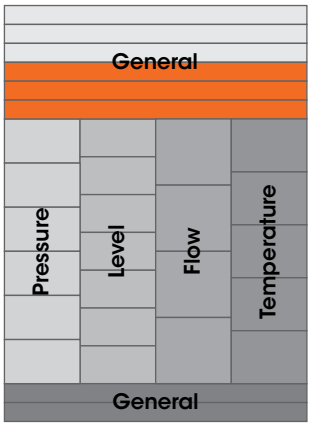


Jacking pump mode	'Disabled' = Pump 1 is a main pump, 'DOL' = When in sleep an assigned output is closed to enable a jacking pump, 'VSD' = Pump 1 configured to operate as a jacking pump.
Jacking pump nominal voltage	Set the voltage as specified on the VSD jacking pump nameplate.
Jacking pump maximum frequency	Set the frequency as specified on the VSD jacking pump nameplate.
Jacking pump full load current	Set the full load current as specified on the VSD jacking pump nameplate.
Jacking pump turn off enable	If enabled the jacking pump will turn off after the 'Jacking pump turn off delay' when at least 1 main pump is operating.
Jacking pump turn off delay	Time of concurrent jacking and main pump running before jacking pump is switched off.

3 - MAIN PUMPS

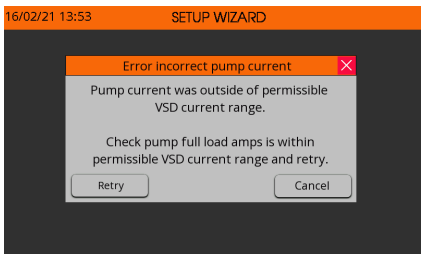
The Setup Wizard page for configuring the main pumps.

Number of pumps	Total number of pumps connected which configures the display and pump selection. This setting is factory set and does not require adjustment.
Pump limit	Maximum number pumps to be running at the same time. Used to limit max flow or max power requirements.
Pump nominal voltage	Set the voltage as specified on the pump nameplate.
Maximum frequency	Set the frequency as specified on the pump nameplate.
Pump full load current	Set the full load current as specified on the pump nameplate.



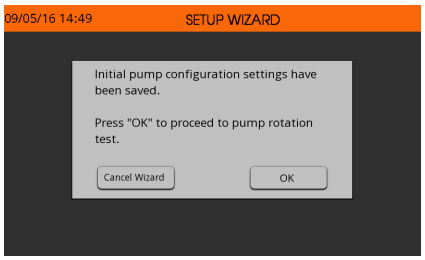
Incorrect Pump Current Warning

If the pump current entered on the previous pages is outside the VSD's acceptable current range, the below warning screen will appear. Press 'Retry' to restart the Setup Wizard.



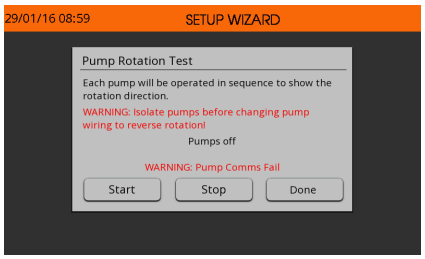
4 - INITIAL SETTINGS SAVED

After the main pumps Wizard screen has been configured, the below screen will appear. The system will briefly restart before the Wizard can be continued. Press 'OK' to continue the Setup Wizard.



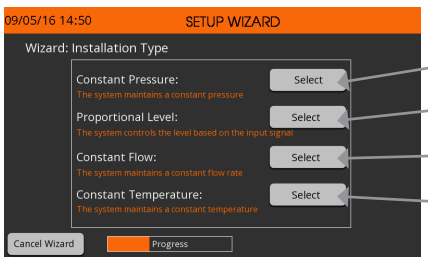
5 - PUMP ROTATION TEST

The pump rotation test allows the user to check the rotation of the pumps. Pressing the start button will cycle through each pump, running it slowly, allowing it to be checked for correct rotation. If rotation is incorrect, ensure power to the pump is isolated then change the wiring.



6 - INSTALLATION TYPE

Select the system type as pressure, level, flow or temperature. This will configure the wizard with specific pages for each control type. See the following pages of this manual for info on each system type:

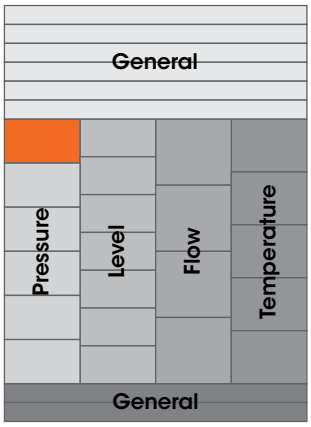


Constant Pressure - See '7A - Pressure Control Setup' on page 28.

Proportional Level - See '7B - Level Control Setup' on page 32.

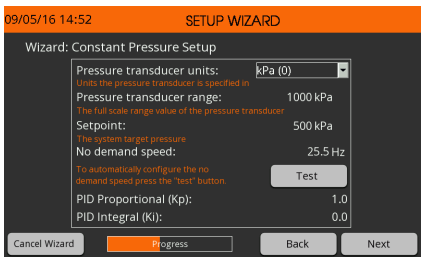
Constant Flow - See '7C - Flow Control Setup' on page 35.

Constant Temperature - See '7D - Temperature Control Setup' on page 37.



7A - PRESSURE CONTROL SETUP - ANALOG & SPEED SETTINGS

The Wizard page for configuring the analog settings, *no demand speed* and PID control in the pressure system type.



Pressure transducer units	Configures the units used for all pressure values.
Pressure transducer range	The max range used for scaling all pressure values.
Setpoint	Target *Setpoint* to be reached by the system.
No demand speed	Once the duty pump speed has dropped below the *No demand speed* for 10 seconds the system will go to sleep. Run the 'Test' to find the correct *no demand speed* for the system.
PID proportional (Kp)	Proportional is the controlled speed response based on the feedback distance from *setpoint*. 'Increase' = More responsive, 'Decrease' = Less responsive. See below for more information on setting the PID.
PID integral (Ki)	Integral is the controlled speed response based on feedback time from *setpoint*. 'Increase' = Slower response, 'Decrease' = Faster response. See below for more information on setting the PID.

ADDITIONAL INFORMATION FOR SETTING THE NO DEMAND SPEED

The *No demand speed* is a critical parameter for the proper operation of the VSD Pressure configuration, particularly for the correct operation of the sleep, pipe fill and destaging functions. The no demand is to be set at the speed (Hz) at which one pump achieves the *setpoint* against a dead head (shut discharge valve). If the system is operating as a mains boosting system with fluctuating mains pressure it is best to set the *no demand speed* for the highest incoming mains pressure.

No demand speed test:

- Enter the required operating *setpoint* in the Setup Wizard before initiating the test.
- Press the no demand speed 'Test' button
- Open the main valve/tap of the system, then press 'Start Test'.
- Slowly close the main tap/valve until just leaking a tiny amount of water, wait for the speed to stabilise, then press 'Complete'. This will automatically set the *no demand speed*.
- If the speed is 20Hz the test failed, run the test again. This time try reopening the valve then closing with a slightly larger leak.

Alternatively, if there is no main discharge valve and no water is being used, follow these steps:

- Enter the required operating *setpoint* then exit the Setup Wizard.
- Ensure that the system pressure is less than the required *setpoint*.
- Put one pump into manual on the pump screen at an initial speed of 25Hz.
- Check if the pressure reading is at the required *setpoint*.
- If not increase the *manual speed* in small steps until system pressure is at the required *setpoint*.
- Once the *setpoint* is reached read the pump speed on the main screen. The *no demand speed* should be set 0.5Hz above this.
- Restart the Wizard and manually enter this speed as the *No Demand Speed*.

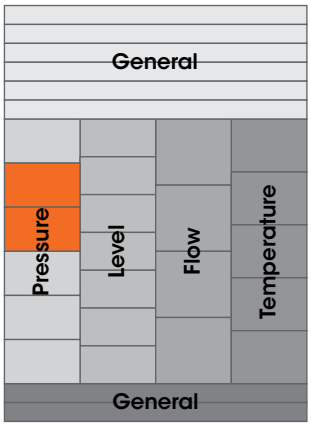
If the *setpoint* is changed then the *no demand speed* will need to be recalculated because it relates to the pump performance at the system pressure.

ADDITIONAL INFORMATION FOR SETTING THE PID

The PID algorithm is used to control the speed of the pumps in the pressure VSD configuration to maintain a stable *setpoint*. Generally larger pumps will need to have a slower PID response to smaller pumps. Care must be taken adjusting these values as they can cause the system to become unstable. Also if the VSD acceleration and deceleration times are too large these delays can cause the system pressure to oscillate. It is best to keep the VSD acceleration and deceleration as quick as possible without causing drive high DC bus faults. Below are some tips to setting the PID:

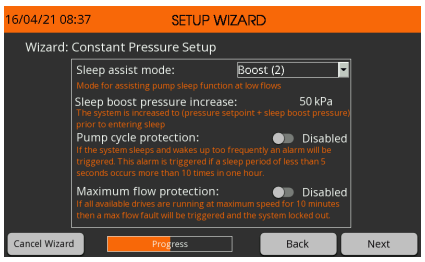
- ***Proportional*** - Increasing the proportional will increase the speed of the PID causing quicker response accelerating and decelerating. Too fast or too slow can cause system pressure over shoot. Set between 0.5(slow) and 2(fast).
- ***Integral*** - Increasing the integral will smooth out the PID when close to the set point. This increases the time to get to stable set point if flow is not changing. Set between 1 (fast/unstable) to 50 (slow/stable).
- ***Derivative*** - Derivative should be left at 1 and not be changed.

Note - PID responsiveness changes based on the analog range. Increasing the analog range will slow down the PID. For example, at 1000kPa with P = 1 and I = 10 would be similar to 1600kPa with P=1 and I = 3.



8A - PRESSURE CONTROL SETUP - SLEEP ASSIST & SYSTEM

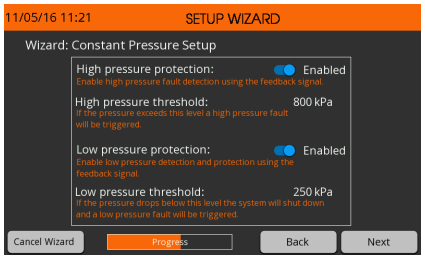
The Wizard page for configuring the sleep assist mode, pump cycle protection and maximum flow protection in the pressure system type.



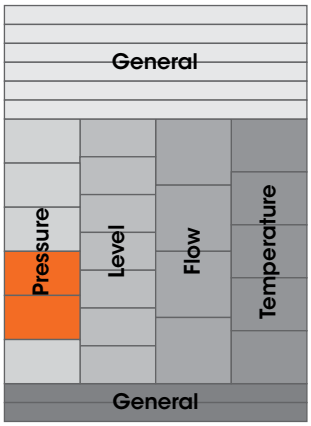
Sleep assist mode	When the pump speed is not varying more than 0.1Hz for 20 seconds the system, if set to 'Speed minimise', will slowly drop the pump speed by to try and reach the *No demand speed*. If set to 'Boost' the system will adjust the *setpoint* to '*setpoint + Sleep boost pressure increase*' to increase the system pressure before returning to the normal *setpoint*. This should slow the pump speed to below the *No demand speed* if there is no system demand.
Sleep boost pressure increase	This is the target pressure above the setpoint which the sleep boost will try and reach before returning to normal operation.
Pump cycle protection	If the system goes to sleep but wakes up within 5 seconds 10 times within an hour, the fault will be activated. The system will be locked out, alarming and shutting down the pumps.
Maximum flow protection	If all available pumps are running at maximum flow for 10 minutes, the fault will be activated. The system will be locked out, alarming and shutting down the pumps.

9A - PRESSURE CONTROL SETUP - HIGH & LOW PRESSURE PROTECTION

The Wizard page for configuring the high and low pressure protection in the pressure system type.

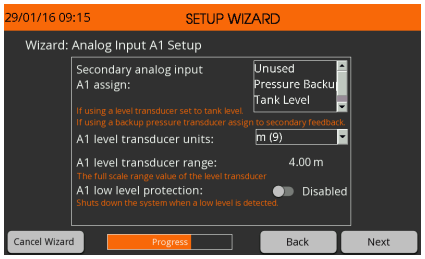


High pressure protection	If enabled the analog feedback is used for triggering the high pressure fault.
High pressure threshold	When the *High pressure protection* is enabled and the analog feedback goes above this threshold the high pressure fault will activate. The system will be locked out, alarming and shutting down the pumps.
Low pressure protection	If enabled the analog feedback is used for triggering the low pressure fault.
Low pressure threshold	When the *Low pressure protection* is enabled and the analog feedback goes below this threshold for 30 seconds, the low pressure fault will activate. The pump speed must be above the *No demand speed* for this to activate. The system will shut down the pumps and wait 60 seconds before auto restart. 5 failed restarts will active a lockout.



10A - Pressure Control Setup - Analog Input A1

The Wizard page for configuring the Analog Input A1 as a backup pressure transducer or tank level transducer, if required. The level transducer settings on this page will only display if the 'Tank Level' option is selected.

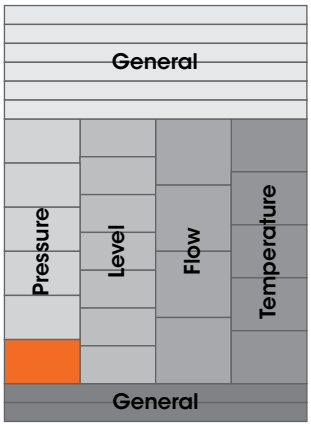


Secondary analog input A1 assign	If using a backup pressure transducer, set to 'Pressure backup'. If using a level transducer to monitor tank level, set to 'Tank level', then adjust the settings below as required.
A1 level transducer units	Configures the units used for all level values.
A1 level transducer range	The max range used for scaling all level values.
A1 low level protection	If enabled and the analog tank level value goes below the *A1 low level protection threshold*, the fault will be activated. The system will be locked out, alarming and shutting down the pumps.
A1 low level protection threshold	If the analog tank level goes below this threshold the *A1 low level protection* fault will be activated.

11A - Pressure Control Setup - Valve Control

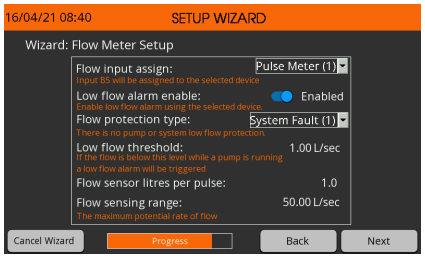
The Wizard page for configuring valve control in the pressure system type. **Note -** The valve output will need to be assigned on the 'Assign Digital BMS' Wizard page for the valve control to operate. This should be requested when ordering.

Mains bypass enable	If enabled, the valve output will be used for a normally open mains bypass valve, energising it shut during normal operation and de-energising the valve open on digital low level, system off, disabled or lockout.
Mains tank fill enable	If enabled and the *Secondary analog input A1 assign* is set to 'Tank Level', the valve output will be used for a normally closed tank top up valve using the *Top up start level* and *Top up stop level*.
Top up stop level	The analog level at which the valve output will be deenergised to close the valve. Must be above the *Top up start level.*
Top up start level	The analog level at which the valve output will be energised to open the valve. Must be below the *Top up stop level.*



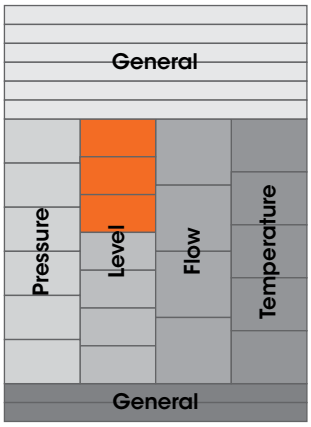
12A - Pressure Control Setup - Low Flow Protection

The Wizard page for setting up the low flow protection in the pressure system type.



Flow input assign	The flow input will be assigned to the selected device, a 'Flow Switch' or 'Pulse Meter'.
Low flow alarm enable	If enabled the selected device will be used to trigger the low flow protection.
Flow protection type	'System Lockout' = If a pump runs with no flow for 30 seconds then the system will be inhibited. 'Pump Fault' = If a pump runs with no flow for 30 seconds then it will be inhibited and another pump brought into operation. The controller will attempt to restart the inhibited pump or system after a 60 second delay. If 5 consecutive restarts fail to achieve flow the pump or system will be locked out. 'Sleep' = If pumps run with no flow for 30 seconds they will be shut down and system will sleep.
Low flow threshold	When the *Low flow protection* is enabled and the analog feedback goes below this threshold for 30 seconds, the low flow fault will activate. The pump speed must be above the *No demand speed* for this to activate. The system will shut down the pumps and wait 60 seconds before auto restart. 10 failed restarts will active a lockout.
Flow sensor litres per hour	The litres per hour used to calculate the flow rate and totalised volume.
Flow sensor range	The max range used for scaling all flow values and the max flow displayed on the trend graph.

Skip to '14 - Assign Digital BMS' on page 40 of this manual to continue the Setup Wizard.



7B - LEVEL CONTROL SETUP - ANALOG SETTINGS & CONTROL

The Wizard page for setting the level units, transducer range and control direction in the level system type.

Tank level units	Configures the units used for all level values.
Level transducer range	The max range used for scaling all level values.

8B - LEVEL CONTROL SETUP - ANALOG & SPEED SETTINGS

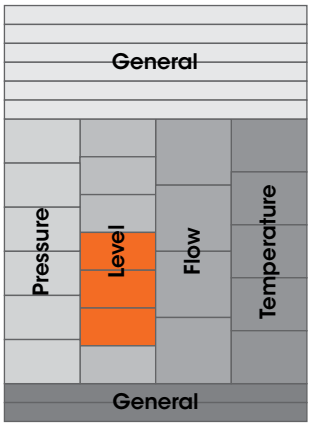
The Wizard page for setting the analog setpoint, duty start and standby start levels, minimum speed and full speed level.

Setpoint	Target *Setpoint* stop level to be reached by the system.
Duty start level	The analog level at which the system will wake up from sleep and the duty pump will start. Ensure this is set below the *setpoint* if the *level control operation* = 'Fill', or above the *setpoint* if the *level control operation* = 'Empty'.
Standby start step	The analog level incremental step from the *Duty start step* at which the standby pumps will start.
Minimum speed	This is the speed the pumps will be running at when the analog value is at the *setpoint*.
Full speed level	The analog level threshold at which the VSDs will be running at maximum speed. Ensure this is set below the *setpoint* if the *level control operation* = 'Fill', or above the *setpoint* if the *level control operation* = 'Empty'.

9B - LEVEL CONTROL SETUP - HIGH & LOW LEVEL PROTECTION

The Wizard page for configuring the high and low level protections.

High level protection	If enabled the analog feedback is used for triggering the high level fault.
High level threshold	When the *High level protection* is enabled and the analog feedback goes above this threshold for 5 seconds, the high level fault will activate, triggering an alarm.
Low level protection	If enabled the analog feedback is used for triggering the low level fault.
Low level threshold	When the *Low level protection* is enabled and the analog feedback goes below this threshold for 3 seconds, the low level fault will activate. The system will be locked out, triggering an alarm and shutting down the pumps.



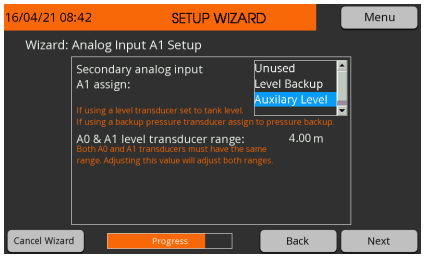
10B - LEVEL CONTROL SETUP - SYSTEM PROTECTIONS

The Wizard page for configuring the pump cycle and max flow protections in the level system type.

Pump cycle protection	If the system goes to sleep but wakes up within 5 seconds 10 times within an hour, the fault will be activated. The system will be locked out, alarming and shutting down the pumps.
Maximum flow protection	If all available pumps are running at maximum flow for 10 minutes, the fault will be activated. The system will be locked out, alarming and shutting down the pumps.

11B - LEVEL CONTROL SETUP - ANALOG INPUT A1

The Wizard page for configuring the Analog Input A1 as a backup or auxiliary tank level transducer, if required. If the 'Auxiliary Level' option is selected, auxiliary high and low protections can be configured on pages 33-34 of the parameters list.

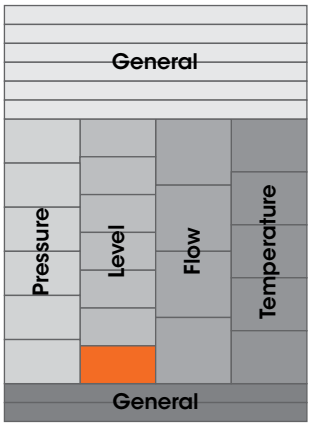


Secondary analog input A1 assign	If using a backup level transducer, set to 'Level Backup'. If using a level transducer to monitor level in an additional tank, set to 'Auxiliary level'.
A0 & A1 level transducer range	The max range used for scaling all level values. This must be the same as the A0 input *level transducer range* set on the first level setup wizard page. Adjusting the value here adjust both ranges.

12B - LEVEL CONTROL SETUP - VALVE CONTROL

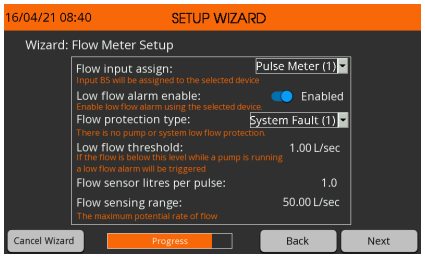
The Wizard page for configuring valve control in the level system type. **Note -** The valve output will need to be assigned on the 'Assign Digital BMS' Wizard page for the valve control to operate. This should be requested when ordering.

Mains tank fill enable	If enabled, when the tank has pumped down to the *setpoint* and the pumps have stopped, and the time since the last well wash exceeds 24 hours, the well wash valve will be energised for 5 minutes.
Top up stop level	The analog level at which the valve output will be deenergised to close the valve. Must be above the *Top up start level.*
Top up start level	The analog level at which the valve output will be energised to open the valve. Must be below the *Top up stop level.*
Well wash enable	If enabled, when the system has pumped down to the *setpoint* and the pumps have stopped, and the time since the last well wash has exceeded 24 hours, the well wash valve will be energised open for 5 minutes. **Note -** The *well wash enable* is unavailable if the *mains tank fill enable* is in use.



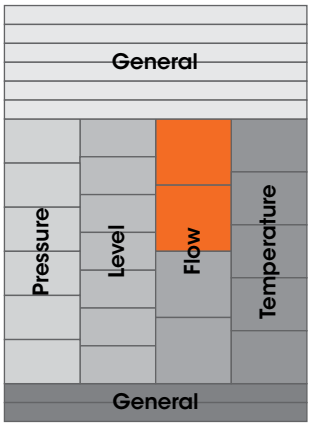
13B - LEVEL CONTROL SETUP - LOW FLOW PROTECTION

The wizard pages for setting up the low flow protection, for the level system type.



Flow input assign	The flow input will be assigned to the selected device, a 'Flow Switch' or 'Pulse Meter'.
Low flow alarm enable	If enabled the selected device will be used to trigger the low flow protection.
Flow protection type	'System Lockout' = If a pump runs with no flow for 30 seconds then the system will be inhibited. 'Pump Fault' = If a pump runs with no flow for 30 seconds then it will be inhibited and another pump brought into operation. The controller will attempt to restart the inhibited pump or system after a 60 second delay. If 5 consecutive restarts fail to achieve flow the pump or system will be locked out. 'Sleep' = If pumps run with no flow for 30 seconds they will be shut down and system will sleep.
Low flow threshold	When the *Low flow protection* is enabled and the analog feedback goes below this threshold for 30 seconds, the low flow fault will activate. The pump speed must be above the *No demand speed* for this to activate. The system will shut down the pumps and wait 60 seconds before auto restart. 10 failed restarts will active a lockout.
Flow sensor litres per hour	The litres per hour used to calculate the flow rate and totalised volume.
Flow sensor range	The max range used for scaling all flow values and the max flow displayed on the trend graph.

Skip to '14 - Assign Digital BMS' on page 40 of this manual to continue the Setup Wizard.



7C - FLOW CONTROL SETUP - FLOW SENSOR & PID SETTINGS

The Wizard page for setting the flow units and range, setpoint and PID control in the flow system type.

Flow units	Configures the units used for all flow values.
Flow sensor litres per pulse	The litres for every pulse used to calculate the flow rate and totalised volume.
Flow sensing range	The max range used for scaling all flow values and the max flow displayed on the trend graph.
Setpoint	Target flow *Setpoint* to be reached by the system.
PID proportional (Kp)	Proportional is the controlled speed response based on the feedback distance from *setpoint*. 'Increase' = More responsive, 'Decrease' = Less responsive. See below for more information on setting the PID.
PID integral (Ki)	Integral is the controlled speed response based on feedback time from *setpoint*. 'Increase' = Slower response, 'Decrease' = Faster response. See below for more information on setting the PID.

Additional information for setting the PID

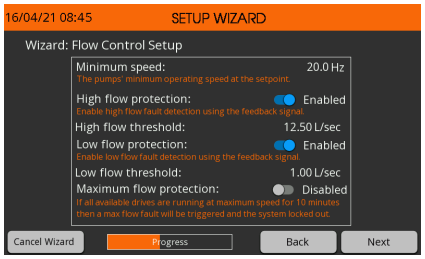
The PID algorithm is used to control the speed of the pumps in the pressure VSD configuration to maintain a stable *setpoint*. Generally larger pumps will need to have a slower PID response to smaller pumps. Care must be taken adjusting these values as they can cause the system to become unstable. Also if the VSD acceleration and deceleration times are too large these delays can cause the system pressure to oscillate. It is best to keep the VSD acceleration and deceleration as quick as possible without causing drive high DC bus faults. Below are some tips to setting the PID:

- ***Proportional*** - Increasing the proportional will increase the speed of the PID causing quicker response accelerating and decelerating. Too fast or too slow can cause system pressure over shoot. Set between 0.5(slow) and 2(fast).
- ***Integral*** - Increasing the integral will smooth out the PID when close to the set point. This increases the time to get to stable set point if flow is not changing. Set between 1 (fast/unstable) to 50 (slow/stable).
- ***Derivative*** - Derivative should be left at 1 and not be changed.

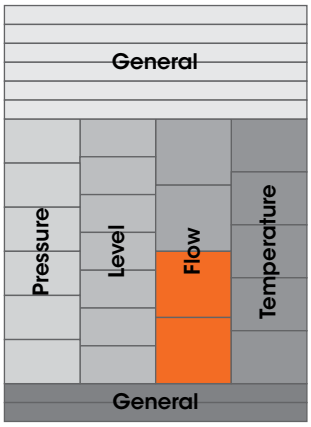
Note - PID responsiveness changes based on the analog range. Increasing the analog range will slow down the PID. For example, at 1000kPa with P = 1 and I = 10 would be similar to 1600kPa with P=1 and I = 3.

8C - FLOW CONTROL SETUP - SPEED SETTINGS & FLOW PROTECTIONS

The Wizard page for setting the minimum speed and the high, low and max flow protections.

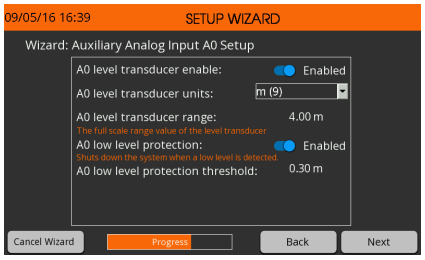


Minimum speed	This is the minimum speed the pumps will be able to run at.
High flow protection	If enabled the analog feedback is used for triggering the high flow fault.
High low threshold	When the *High flow protection* is enabled and the analog feedback goes above this threshold for 10 seconds the high flow fault will activate, triggering an alarm.
Low flow protection	If enabled the analog feedback is used for triggering the low flow fault.
Low flow threshold	When the *Low flow protection* is enabled and the analog feedback goes below this threshold for 30 seconds, the low flow fault will activate. The pump speed must be above the *No demand speed* for this to activate. The system will shut down the pumps and wait 60 seconds before auto restart. 10 failed restarts will activate a lockout.
Maximum flow protection	If all available pumps are running at maximum flow for 10 minutes, the fault will be activated. The system will be locked out, alarming and shutting down the pumps.



9C - FLOW CONTROL SETUP - AUXILIARY ANALOG INPUT A0

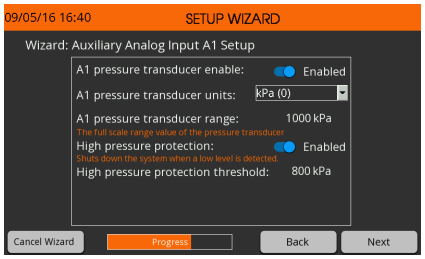
The Wizard page for configuring the Analog Input A0 for a tank level transducer, if required. If not required, set to disabled and skip this page.



A0 level transducer enable	If enabled a level transducer can be used to monitor tank level. If in use, adjust the settings below as required.
A0 level transducer units	Configures the units used for all level values.
A0 level transducer range	The max range used for scaling all level values.
A0 low level protection	If enabled and the analog tank level value goes below the *A0 low level protection threshold*, the fault will be activated. The system will be locked out, alarming and shutting down the pumps.
A0 low level protection threshold	If the analog tank level goes below this threshold the *A0 low level protection* fault will be activated.

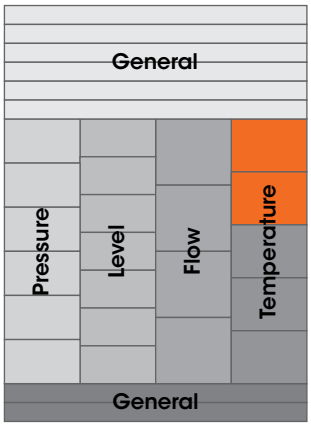
10C - FLOW CONTROL SETUP - AUXILIARY ANALOG INPUT A1

The Wizard page for configuring the Analog Input A1 for a pressure transducer, if required. If not required, set to disabled and skip this page.



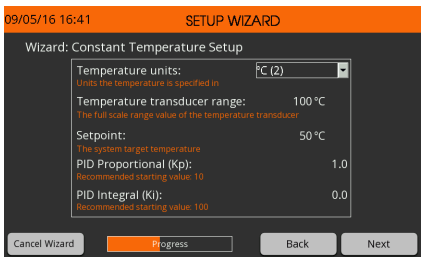
A1 pressure transducer enable	If enabled, a pressure transducer can be used to monitor the system pressure. If in use, adjust the settings below as required.
A1 pressure transducer units	Configures the units used for all pressure values.
A1 pressure transducer range	The max range used for scaling all pressure values.
High pressure protection	If enabled and the analog pressure value goes above the *High pressure protection threshold*, the fault will be activated. The system will be locked out, alarming and shutting down the pumps.
High pressure protection threshold	If the analog pressure goes above this threshold the *High pressure protection* fault will be activated.

Skip to '14 - Assign Digital BMS' on page 40 of this manual to continue the Setup Wizard.



7D - TEMPERATURE CONTROL SETUP - ANALOG & PID SETTINGS

The Wizard page for setting the temperature units, analog range, setpoint and PID control in the temperature system type.



Temperature units	Configures the units used for all temperature values.
Temperature transducer range	The max range used for scaling all temperature values.
Setpoint	Target *Setpoint* to be reached by the system.
PID proportional (Kp)	Proportional is the controlled speed response based on the feedback distance from *setpoint*. 'Increase' = More responsive, 'Decrease' = Less responsive. See below for more information on setting the PID.
PID integral (Ki)	Integral is the controlled speed response based on feedback time from *setpoint*. 'Increase' = Slower response, 'Decrease' = Faster response. See below for more information on setting the PID.

Additional information for setting the PID

The PID algorithm is used to control the speed of the pumps in the pressure VSD configuration to maintain a stable *setpoint*. Generally larger pumps will need to have a slower PID response to smaller pumps. Care must be taken adjusting these values as they can cause the system to become unstable. Also if the VSD acceleration and deceleration times are too large these delays can cause the system pressure to oscillate. It is best to keep the VSD acceleration and deceleration as quick as possible without causing drive high DC bus faults. Below are some tips to setting the PID:

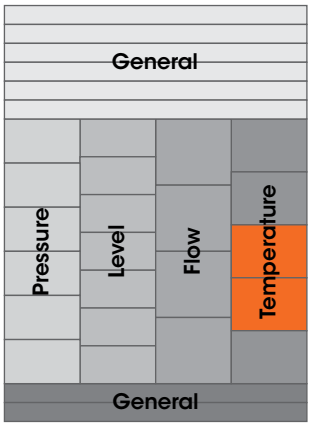
- ***Proportional*** - Increasing the proportional will increase the speed of the PID causing quicker response accelerating and decelerating. Too fast or too slow can cause system pressure over shoot. Set between 0.5(slow) and 2(fast).
- ***Integral*** - Increasing the integral will smooth out the PID when close to the set point. This increases the time to get to stable set point if flow is not changing. Set between 1 (fast/unstable) to 50 (slow/stable).
- ***Derivative*** - Derivative should be left at 1 and not be changed.

Note - PID responsiveness changes based on the analog range. Increasing the analog range will slow down the PID. For example, at 1000kPa with P = 1 and I = 10 would be similar to 1600kPa with P=1 and I = 3.

8D - TEMPERATURE CONTROL SETUP - CONTROL DIRECTION, SPEED & ALTERNATION

The Wizard page for setting the control direction, minimum speed and duty change period in the temperature system type.

Temperature control operation	Sets the control direction as 'Heat' or 'Cool'.
Minimum speed	This is the minimum speed the pumps will be able to run at.
Duty change period	The duty pump running time before initiating a duty change to the next pump with the least run hours.



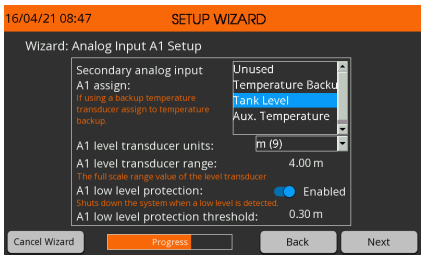
9D - TEMPERATURE CONTROL SETUP - HIGH & LOW TEMP

The Wizard page for configuring the high and low temperature protections.

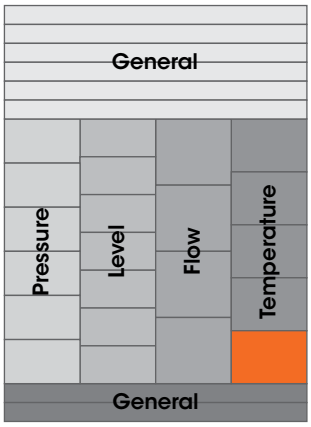
High temperature protection	If enabled the analog feedback is used for triggering the high temperature fault.
High temperature threshold	When the *High temperature protection* is enabled and the analog feedback goes above this threshold for 10 seconds the high temperature fault will activate, triggering an alarm.
Low temperature alarm	If enabled the analog feedback is used for triggering the low temperature fault.
Low temperature threshold	When the *Low temperature protection* is enabled and the analog feedback goes below this threshold for 10 seconds, the low temperature fault will activate, triggering an alarm.

10D - TEMPERATURE CONTROL SETUP - ANALOG INPUT A1

The Wizard page for configuring the Analog Input A1 as a backup or auxiliary temperature sensor or a tank level transducer, if required.The level transducer settings will only display if the 'Tank Level' option is selected. If 'Auxiliary Temperature' is selected, auxiliary alarms can be configured on the following Wizard page.

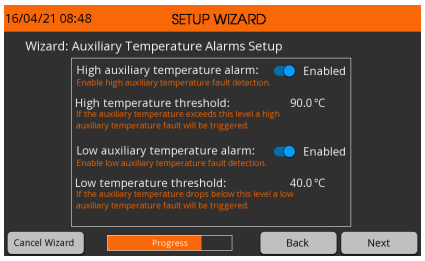


Secondary analog input A1 assign	If using a backup temperature transducer, set to 'Temperature backup'. If using a level transducer to monitor tank level, set to 'Tank level', then adjust the settings below as required. If using an auxiliary temperature sensor, set to 'Aux temp' and adjust the settings on the following page as required.
A1 level transducer units	Configures the units used for all level values.
A1 level transducer range	The max range used for scaling all level values.
A1 low level protection	If enabled and the analog tank level value goes below the *A1 low level protection threshold*, the fault will be activated.The system will be locked, alarming and shutting down the pumps.



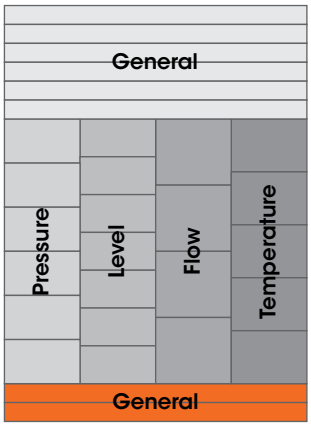
11D - TEMPERATURE CONTROL SETUP - AUXILIARY TEMPERATURE

The Wizard page for configuring the auxiliary high and low temperature alarms, if the A1 Analog Input is set to 'Auxiliary Temperature'. on the previous Wizard page. These settings will not display if this option is not selected.



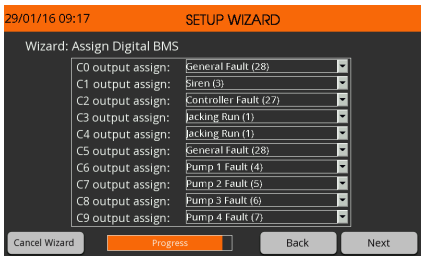
High auxiliary temperature alarm	If enabled the A1 analog feedback is used for triggering the high auxiliary temperature fault.
High temperature threshold	When the *High auxiliary temperature protection* is enabled and the A1 analog feedback goes above this threshold for 10 seconds the high auxiliary temperature fault will activate, triggering an alarm.
Low auxiliary temperature alarm	If enabled the A1 analog feedback is used for triggering the low auxiliary temperature fault.
Low temperature threshold	When the *Low auxiliary temperature protection* is enabled and the analog feedback goes below this threshold for 10 seconds, the low auxiliary temperature fault will activate, triggering an alarm.

Skip to '14 - Assign Digital BMS' on page 40 of this manual to continue the Setup Wizard.



14 - ASSIGN DIGITAL BMS

The wizard pages for assigning the digital BMS outputs. These will typically be preset to match the din rail terminals provided in the HydroTOUCH VSD controller, see 'Connections' on page 16 for more information. Different connections can be provided upon request.

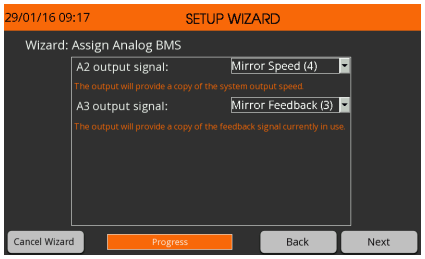


Digital BMS output options include:

- Pump 1-12 Fault
- Pump 1-12 Run
- A0/A1 input fault
- Analog input fault
- Low level fault
- High level fault
- High pressure fault
- Low pressure fault
- Pipe fill fail fault
- Pump cycle fault
- No drive access
- No pumps available
- Controller fault
- General fault
- Direct control
- Drive config fault
- Max flow fault
- UV 1/2 fault
- Filter 1/2 blocked
- Filter 1/2 fault
- System healthy
- System lockout
- Rain water
- Mains water
- Medium level fault
- Low flow fault
- High flow fault
- High temp fault
- High aux temp fault
- Low temp fault
- Low aux temp fault
- A0/A1 backup discrepancy
- Low aux level fault
- High aux level fault
- Common pump fault
- Common pump fault

15 - ASSIGN ANALOG BMS

The wizard pages for assigning the analog BMS outputs. Din rail mount terminals are not provided for these connections as standard, but they can be wired directly to the module if required, or provided upon request.

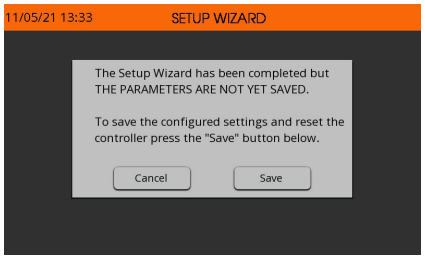


Analog BMS output options include:

- Unassigned
- Mirror A0
- Mirror A1
- Mirror feedback
- Mirror speed

16 - SAVE

Once the Setup Wizard is complete, press save to save the settings and proceed to the main screen to begin operation.

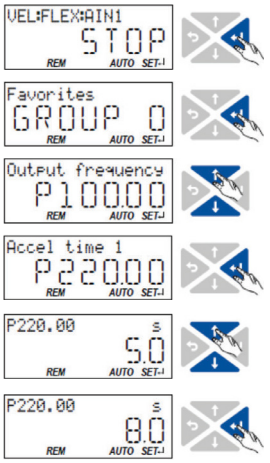


VSD COMMISSIONING (LENZE DRIVES)

See following pages for ABB or Nidec drive commissioning.
To commission VSDs access to live parts is required. This step should only be completed by someone suitably qualified to do so.

KEYPAD NAVIGATION

Follow the steps below to enter and edit the parameters list.



1. Use the ↵ key in the operating mode to navigate to the parameterisation mode one level below. You are now in the group level. All parameters are divided into different groups according to their function .Group '0' contains the 'favourites'. Note: By using the ↩ key you can navigate upwards again anytime.
2. Use the ↵ key to navigate to one level below. You are now in the parameter level of the group selected.
3. Use the ↑ and ↓ navigation keys to select the desired parameter.
4. Use the ↵ key to navigate to one level below. You are now in the editing mode.
5. Set the desired value using the ↑ and ↓ navigation keys.
6. Use the ↵ key to accept the changed setting. The editing mode is exited. Note: By using the ↩ key you can exit the editing mode without accepting the new setting (abort).

SAVING THE PARAMETER SETTING WITH THE KEYPAD

If one parameter setting has been changed with the keypad but has not been saved in the memory module with the mains failure protection, the SET display is blinking. In order to save the parameter settings in the user memory of the module, press the keypad enter key for more than 3s.

SET PUMP PARAMETERS

The pump motor data MUST be entered into each drive to ensure proper control and direction.
The main pump parameters (GROUP 3) should be entered as below.

0x2C01:004 (P320.04)	Motor parameters: Rated speed (Motor parameters: Rated speed) Device for 50-Hz mains: 50... [1450] ...50000 rpm Device for 60-Hz mains: 50... [1750] ...50000 rpm	General motor data. Carry out settings as specified by motor nameplate data. Note! When you enter the motor nameplate data, take into account the phase connection implemented for the motor (star or delta connection). Only enter the data applying to the connection type selected.
0x2C01:005 (P320.05)	Motor parameters: Rated frequency (Motor parameters: Rated frequency) Device for 50-Hz mains: 1.0... [50.0] ...1000.0 Hz Device for 60-Hz mains: 1.0... [60.0] ...1000.0 Hz	
0x2C01:006 (P320.06)	Motor parameters: Rated power (Motor parameters: Rated power) 0.00 ... [0.25]* ... 655.35 kW * Default setting depending on the size.	
0x2C01:007 (P320.07)	Motor parameters: Rated voltage (Motor parameters: Rated voltage) 0 ... [230]* ... 65535 V * Default setting depending on the size.	
0x2C01:008 (P320.08)	Motor parameters: Cosine phi (Motor parameters: Cosine phi) 0 ... [0.80] ... 1.00	General motor data. Carry out settings as specified by motor nameplate data.
0x6075 (P323.00)	Motor rated current (Motor current) 0.001 ... [1.700] ... 500.000 A * Default setting depending on the size. • Setting can only be changed if the inverter is inhibited.	The rated motor current that needs to be set here serves as a reference value for different parameters that involve a setting for/display of a current value in percent. Example: • Motor rated current = 1.7 A • Max current 0x6073 (P324.00) = 200% Motor rated current = 3.4A

REPEAT FOR ALL VSDS IN THE PANEL

Once setup is completed for the first VSD, remove the screen and connect to the other VSDs in the panel and commission them.

VSD COMMISSIONING (ABB)

See previous page for Lenze drive commissioning or following page for Nidec drive commissioning.
To commission VSDs access to live parts is required.This step should only be completed by someone suitably qualified to do so.

VSD CONTROL PANEL OVERVIEW

The following table summarises the key functions and displays on the basic control panel.

No.	Use
1	LCD display – Divided into five areas: a. Upper left – Control location: LOC: drive control is local, that is, from the control panel REM: drive control is remote, such as the drive I/O or fieldbus. b. Upper right – Unit of the displayed value. c. Center – Variable; in general, shows parameter and signal values, menus or lists. Shows also fault and alarm codes. d. Lower left and center – Panel operation state: OUTPUT: Output mode PAR: Parameter mode MENU: Main menu FAULT: Fault mode e. Lower right – Indicators: FWD (forward) / REV (reverse): direction of the motor rotation Flashing slowly: stopped Flashing rapidly: running, not at setpoint Steady: running, at setpoint SET: Displayed value can be modified (in the Parameter and Reference modes).
2	RESET/EXIT – Exits to the next higher menu level without saving changed values. Resets faults in the Output and Fault modes.
3	MENU/ENTER – Enters deeper into menu level. In the Parameter mode, saves the displayed value as the new setting.
4	Up – • Scrolls up through a menu or list. • Increases a value if a parameter is selected. • Increases the reference value in the Reference mode. • Holding the key down changes the value faster.
5	Down – • Scrolls down through a menu or list. • Decreases a value if a parameter is selected. • Decreases the reference value in the Reference mode. • Holding the key down changes the value faster.
6	LOC/REM – Changes between local and remote control of the drive.
7	DIR – Changes the direction of the motor rotation.
8	STOP – Stops the drive in local control.
9	START – Starts the drive in local control.

SET PUMP PARAMETERS

No	Name	Description	Units
9905	MOTOR NOM VOLT	Defines the nominal motor voltage. Must be equal to the value on the motor rating plate.	Volts
9906	MOTOR NOM CURR	Defines the nominal motor current. Must be equal to the value on the motor rating plate.	Amps
9907	MOTOR NOM FREQ	Defines the nominal motor frequency, ie the frequency at which the output voltage equals the nominal motor voltage	Hz
9908	MOTOR NOM SPEED	Defines the nominal motor speed. Must be equal to the value on the motor rating plate.	rpm
9909	MOTOR NOM POWER	Defines the nominal motor power. Must equal the value on the motor rating plate.	kW

REPEAT FOR ALL VSDS IN THE PANEL

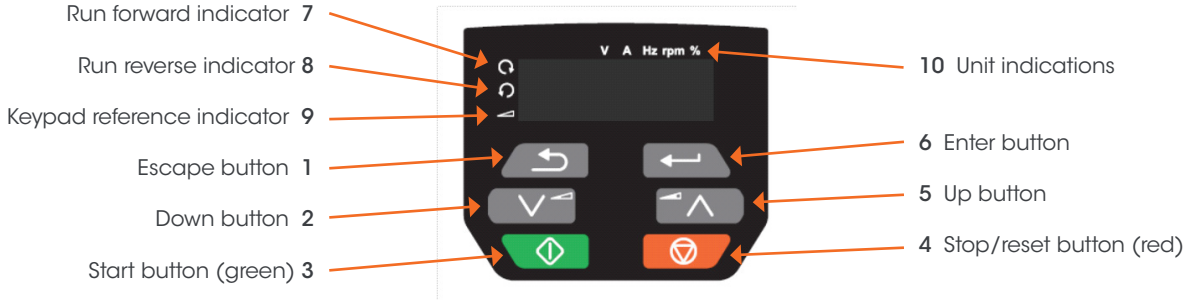
Once setup is completed for the first VSD, remove the screen and connect to the other VSDs in the panel and commission them.

VSD COMMISSIONING (NIDEC DRIVES)

See previous pages for Lenze or ABB drive commissioning.
To commission VSDs access to live parts is required. This step should only be completed by someone suitably qualified to do so.

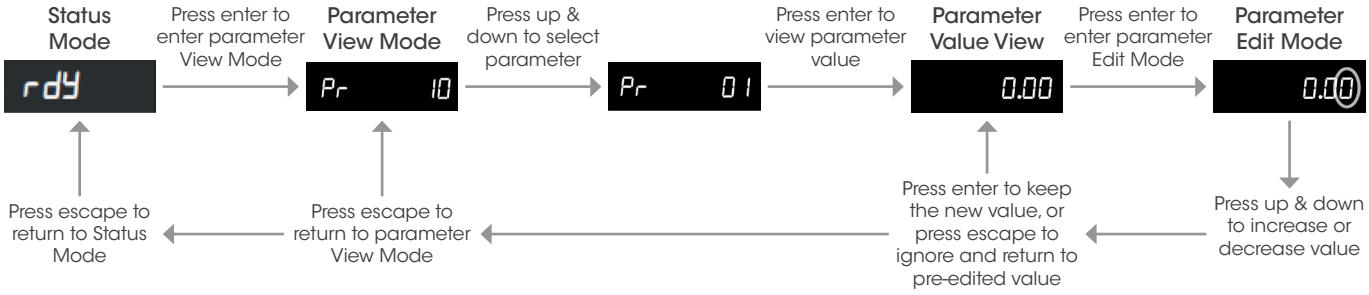
VSD CONTROL PANEL OVERVIEW

The following table summarises the key functions and displays on the basic control panel.



No.	Description	Use
6	Enter button	Used to change between parameter edit and view mode, as well as entering data. This button can also select between slot menu and parameter display.
2 & 5	Up and down buttons	Used to navigate the parameter structure and change parameter values.
1	Escape button	Used to exit from parameter edit and view mode, as well as entering data. In parameter edit mode, if parameter values are edited and the escape button is pressed, the parameter value will be restored to the value it had on entry to edit mode.
3	Start button (green)	Used to provide a run command if keypad mode is selected.
4	Stop/reset button (red)	Used to reset the drive. In keypad mode can be used for 'stop'.

VSD CONTROL PANEL NAVIGATION



SAVING PARAMETERS

After parameters have been changed, parameter 00 must be set to 'save', then press the red Stop/Reset Button to save them.

SET PUMP PARAMETERS

No	Name	Description	Units
0.06	Motor Rated Current	Defines the nominal motor current. Must be equal to the value on the motor rating plate.	Amps
0.07	Motor Rated Speed	Defines the nominal motor speed. Must be equal to the value on the motor rating plate.	rpm
0.08	Motor Rated Voltage	Defines the nominal motor voltage. Must be equal to the value on the motor rating plate.	Volts
0.09	Motor Rated Power Cosine	Defines the motor rated power factor. Must be equal to the value on the motor rating plate.	ϕ
0.39	Motor Rated Frequency	Defines the nominal motor frequency, ie the frequency at which the output voltage equals the nominal motor voltage	Hz

REPEAT FOR ALL VSDS IN THE PANEL

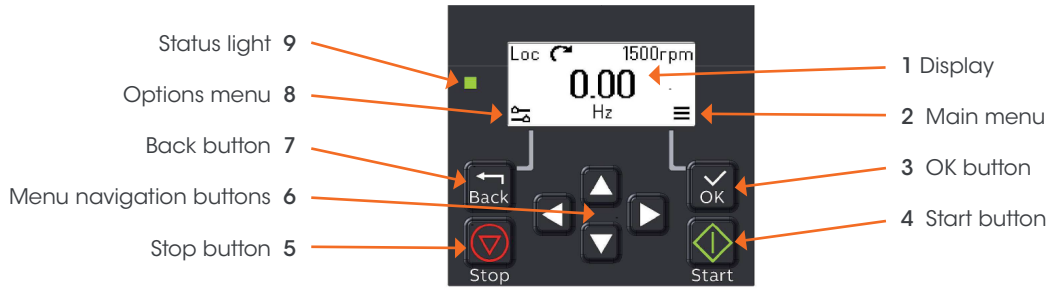
Once setup is completed for the first VSD, remove the screen and connect to the other VSDs in the panel and commission them.

VSD COMMISSIONING (ABB ACS180)

See previous pages for Lenze or ABB drive commissioning.
To commission VSDs access to live parts is required. This step should only be completed by someone suitably qualified to do so.

VSD CONTROL PANEL OVERVIEW

The following table summarises the key functions and displays on the basic control panel.



No.	Description	Use
1	Display	shows the *Home* view as default.
2	Main menu	Main menu display.
3	OK button	open the Main menu, select and save settings.
4	Start button	Start the drive.
5	Stop button	stop the drive.
6	Menu navigation buttons	Move in the menus and set values.
7	Back button	Open the Options menu, and move back in the menu.
8	Options menu	Options menu display.
9	Status light	Green and red colors indicate the state and potential problems.

1 - SET PUMP PARAMETERS

No	Name	Description	Units
99:06	MOTOR NOM CURR	Defines the nominal motor current. Must be equal to the value on the motor rating plate.	Amps
99:07	MOTOR NOM VOLT	Defines the nominal motor voltage. Must be equal to the value on the motor rating plate.	Volts
99:08	MOTOR NOM FREQ	Defines the nominal motor frequency, ie the frequency at which the output voltage equals the nominal motor voltage	Hz
99:09	MOTOR NOM SPEED	Defines the nominal motor speed. Must be equal to the value on the motor rating plate.	rpm
99:10	MOTOR NOM POWER	Defines the nominal motor power. Must equal the value on the motor rating plate.	kW

2 - REPEAT FOR ALL VSDS IN THE PANEL

Once setup is completed for the first VSD, remove the screen and connect to the other VSDs in the panel and commission them.

HMI OPERATION

MAIN SCREEN

The default screen on the HydroTOUCH VSD HMI, providing an overview of the system and pump status, alarms and system mode.

System Status (see 'Diagnostics' on page 36 for list of system states)

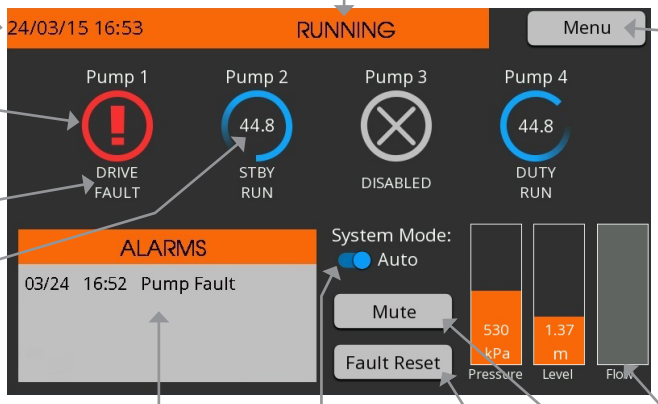
Current time and date

Touch to go to individual **Pump** screen for additional information, enable/disable and auto/manual control

Pump status (see 'Diagnostics' on page 38 for list of pump states)

Current pump speed

Number of pumps displayed on this screen is based on the selection in the setup (up to 12 pumps)



Tap to bring up menu, to access other screens. See below for more information

Current alarms, tap to access **Alarms screen**

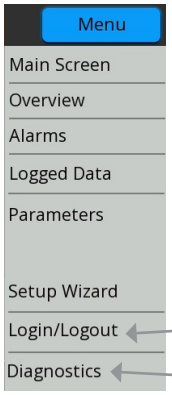
Tap to adjust system mode between auto and off

Tap to reset faults

Tap to mute alarms

Current analog values (display based on the analog input configuration in setup wizard)

MENU



Tap to access Main Screen, when in any other screen.

Tap to access Overview screen. See 'Overview Screen' on page 46 for more information.

Tap to access Alarms screen. See 'Fault Diagnosis' on page 45 for more information.

Tap to access Logged Data screen. See 'Logged Data' on page 31 for more information.

Tap to access the Parameter List. See 'Parameters' on page 33 for more information.

Tap to access the Setup Wizard. See 'Setup Wizard' on page 18 for more information.

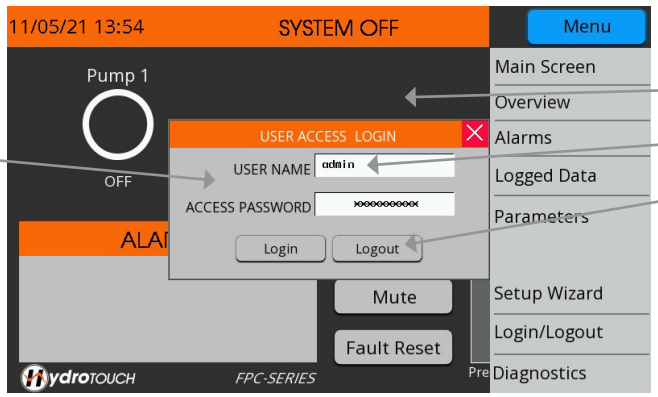
Tap to login or logout of the controller. See below for more information.

Tap to access the Diagnostics screen. See 'Diagnostics' on page 42 for more information.

LOGIN

Login is required for performing various actions on the HMI, such as putting the system in manual mode, resetting logged data and configuring the controller through the setup wizard. There are two levels of access to the controller:
For onsite pump control and resetting faults, login using:
User name: user, password: 1234
For full access to the setup wizard, parameter list and resetting logged data, login using:
User name: admin, password: 5555
Note - When entering the password, the pre-populated 'x's do not need to be deleted. Enter above password over the top.

Touch to login, after entering the username and password



Touch to enter the user name

Touch to enter the password

Touch to logout. The system will automatically logout if left logged in.

PUMP SCREEN

The individual pump monitoring and control screen.

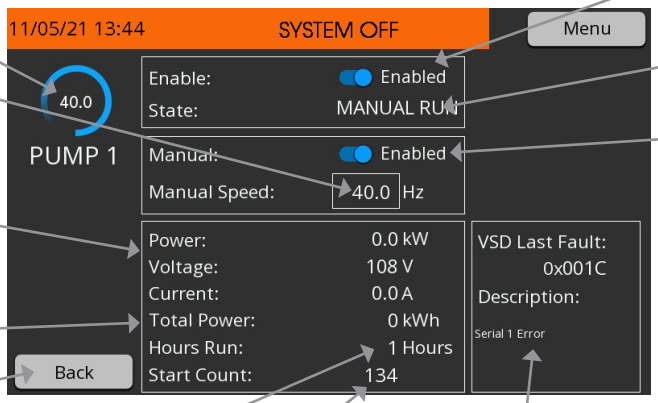
Current pump speed

Touch to adjust the manual speed. This is the speed that the pump will run at when manual mode is enabled.

Current pump speed, power, voltage and current.

Total power usage

Return to main screen



Total pump run hours

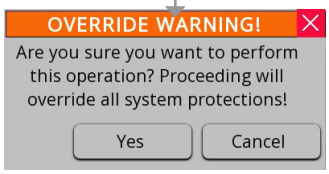
Number of pump starts

Last VSD fault code and description. See 'VSD Fault Diagnosis' for causes and remedies

Touch to enable or disable the pump

Pump status (see 'Diagnostics' on page 49 for list of pump states)

Touch to enable or disable pump manual mode. The pump must be enabled for this to function. If the system is in fault lockout, a manual override warning will appear. The pump can still be placed in manual and will revert to auto mode after 15 minutes.



If system protections are overridden when a pump is placed in manual mode, this warning will appear on the **Main** screen.

OVERVIEW SCREEN

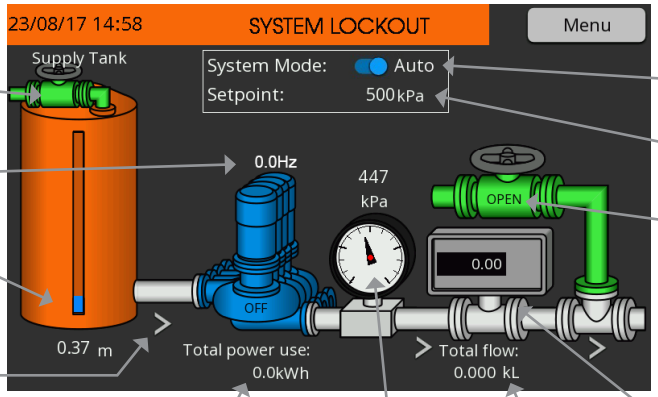
The overview screen is a useful tool for monitoring the entire system operation. The graphics displayed on this screen will be automatically configured based on the selections made in the Setup Wizard. For example, the screen below displays for a system operating in the pressure control system type, with A1 analog input assigned to tank level monitoring, a flow meter installed and mains bypass valve control enabled.

Mains tank top up or well wash valve status (if enabled) Green = open, grey = closed

Current pump speed

Current supply tank level (if analog input A1 is assigned to tank level monitoring)

Arrows show direction of flow in the system



Power usage

System pressure

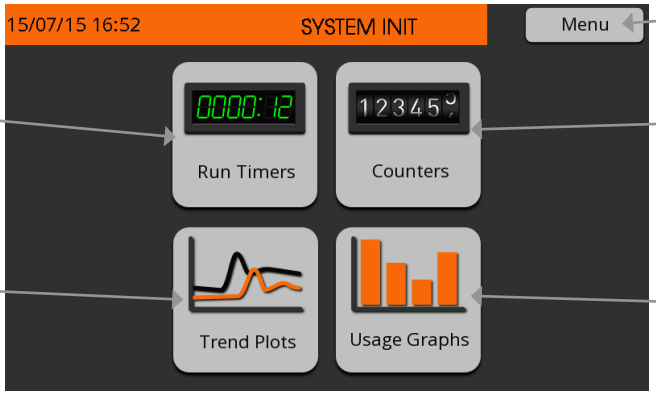
Total flow and current flow rate (if pulse meter input is enabled)

Touch to adjust system mode between auto and off

System *setpoint* (configured in the setup wizard)

Mains bypass valve status (if enabled) Green = open, grey = closed

LOGGED DATA



Touch to access pump and system run timers

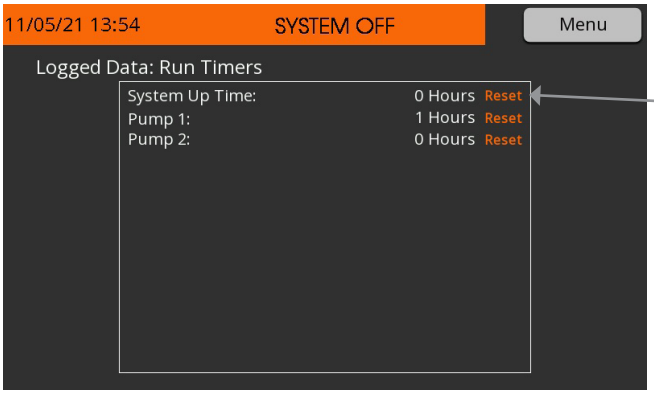
Touch to access analog pressure, level, flow and temperature value trend graphs

Touch to return to **Menu**

Touch to access system event counters

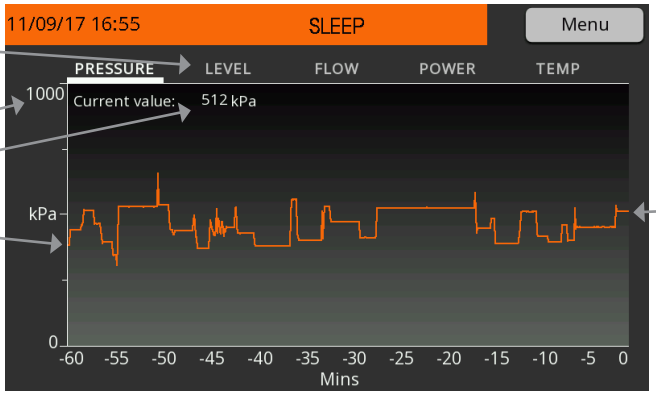
Touch to access power and water usage graphs

RUN TIMERS



Touch to reset timer. See following page for more info.

TREND PLOTS



Touch to view other analog value trend graphs

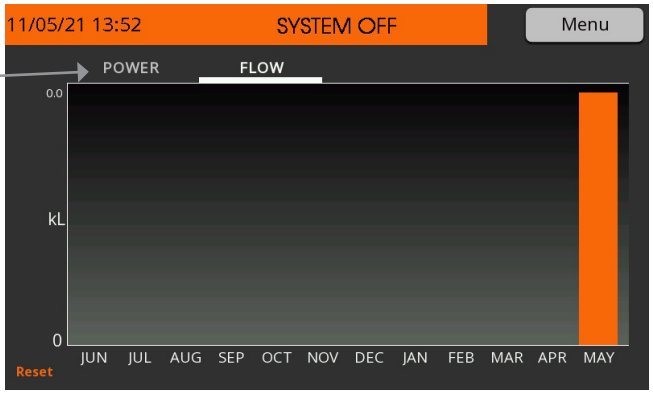
Analog sensor max range

Current analog value

Analog value 60 mins ago

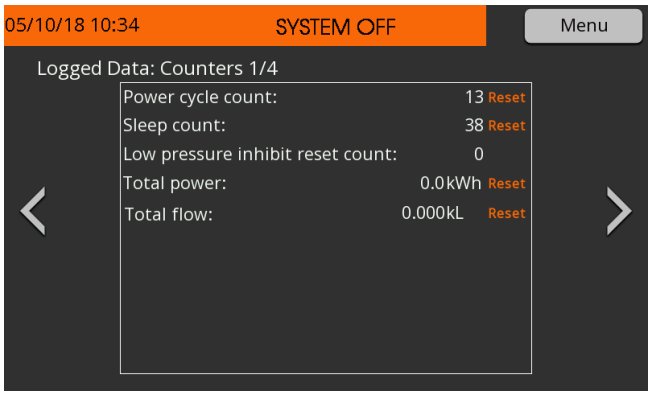
Current analog value

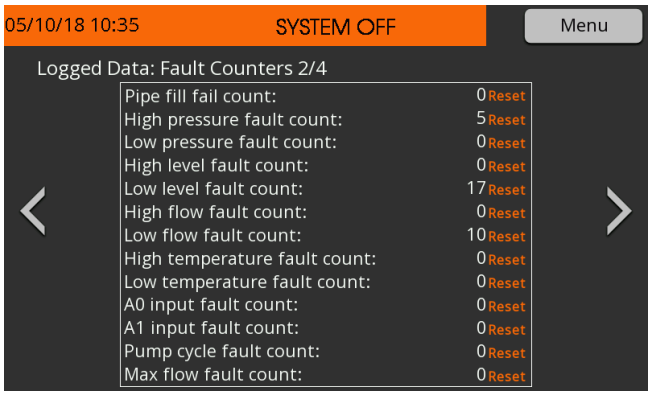
USAGE GRAPHS

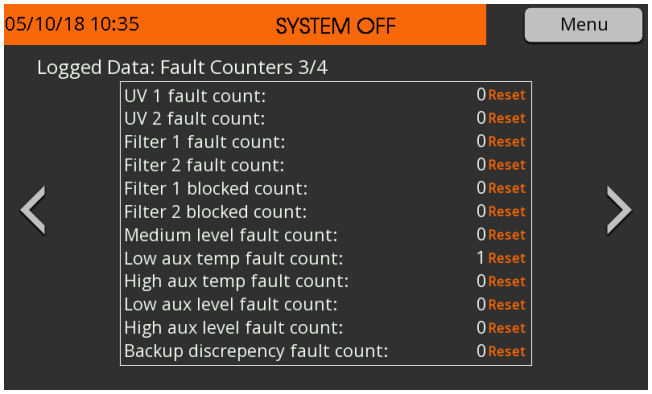


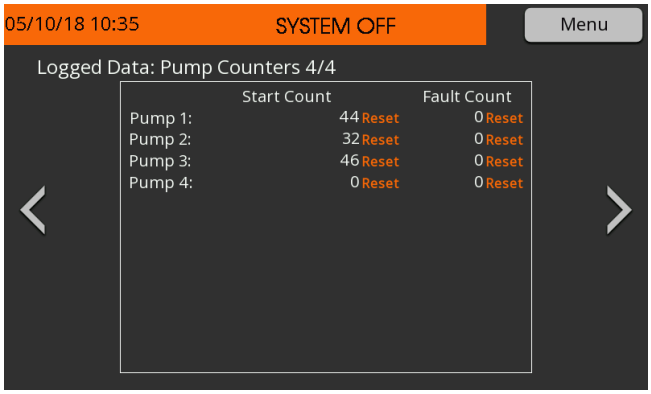
Touch to swap to power usage graph

COUNTERS



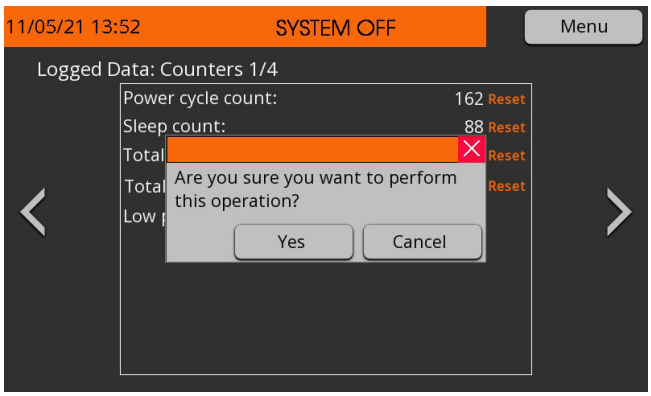






RESETTING LOGGED DATA

Pressing 'Reset' beside any logged value on the logged data screens will bring up the 'Logged Value Reset' box, allowing you to confirm or cancel the reset of the data. Login will be required first if not already logged in.
Note - If the HydroTOUCH VSD is reset back to the factory defaults on the Diagnostics page, all the logged data will be reset.

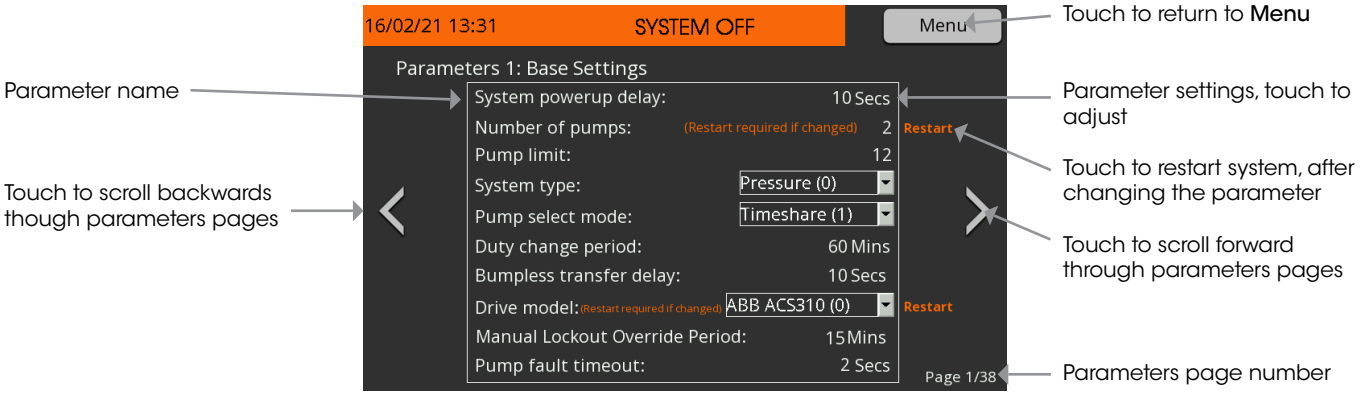


PARAMETERS

Warning: Adjusting any individual parameters through this menu may cause unexpected issues with the function and operation of the controller and should only be done after consulting a technician. Adjustments to settings should be made through the Setup Wizard where possible.

PARAMETERS SCREEN OPERATION

The parameters screen displays a list of all the parameters that are used in the operation of the system. The Setup Wizard is used for initial configuration of the controller, not the parameters screen. Adjusting any other parameters in this screen may cause issues with the function and operation of the controller and should only be done after consulting a technician.



PARAMETERS LIST

For a full list of all the parameters with default settings and descriptions, see the **HydroTOUCH VSD Parameters List** document.

SCADA COMMUNICATION

DEFAULT COMMUNICATION SETTINGS

The default Modbus RTU SCADA communication settings are Baud:19200, Parity: 8N1, Slave:1. These settings can be changed through the SCADA setup on page 37 of the parameters list.

ACCEPTED MODBUS FUNCTION CODES

The HydroTOUCH VSD Modbus links support the following function codes:

01	Read coil status
02	Read input status
03	Read holding registers
05	Force single coil
06	Preset single register
16	Preset multiple registers (maximum of 32)

Care should be taken not to poll the communications too frequently, as this can cause the controller's response to become sluggish.

DATA FORMAT

All data is stored as big endian unsigned integers with the MSB on the left, unless otherwise stated. The first register starts at 1 and the actual number sent in the Modbus packet will be the register number -1.

WATCHDOG TIMER

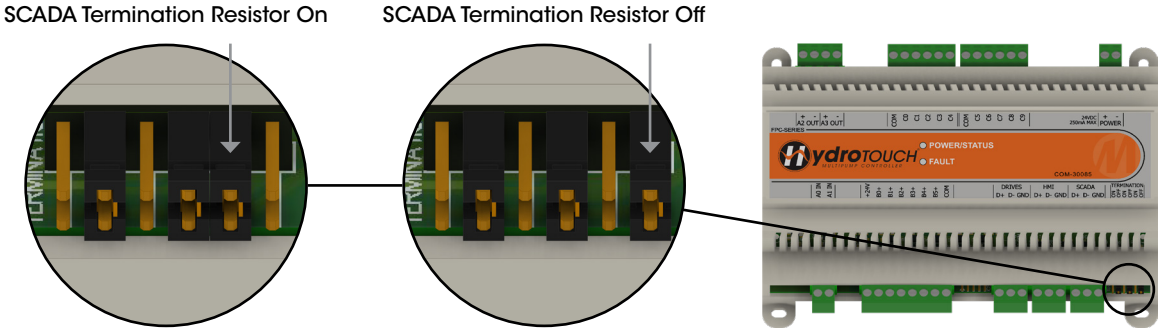
The SCADA communication has the ability to enable a watchdog timer to shutdown the pump operation and trigger an alarm if communication with the SCADA system is lost. If the watchdog timer is enabled, register 967 needs to be written to 1 at a faster frequency than the SCADA Watchdog Timer otherwise the 'SCADA Watchdog Timeout' alarm will activate and the pumps shutdown. As soon as this register is written successfully again the system will automatically restart operation and clear the fault.

MODBUS REGISTERS

Modbus registers are accessible directly via the diagnostics page direct data access. See 'Diagnostics' on page 47 for more info. See the **HydroTOUCH VSD Modbus Registers** document for full list of Modbus registers.

TERMINATION RESISTOR

On long cable runs a termination resistor may be required. To enable the resistor, move the jumper at the bottom right of the HydroTOUCH module to the ON position. In shorter cable runs, or with some connected devices, the termination resistor may not be required and can be put in the OFF position.



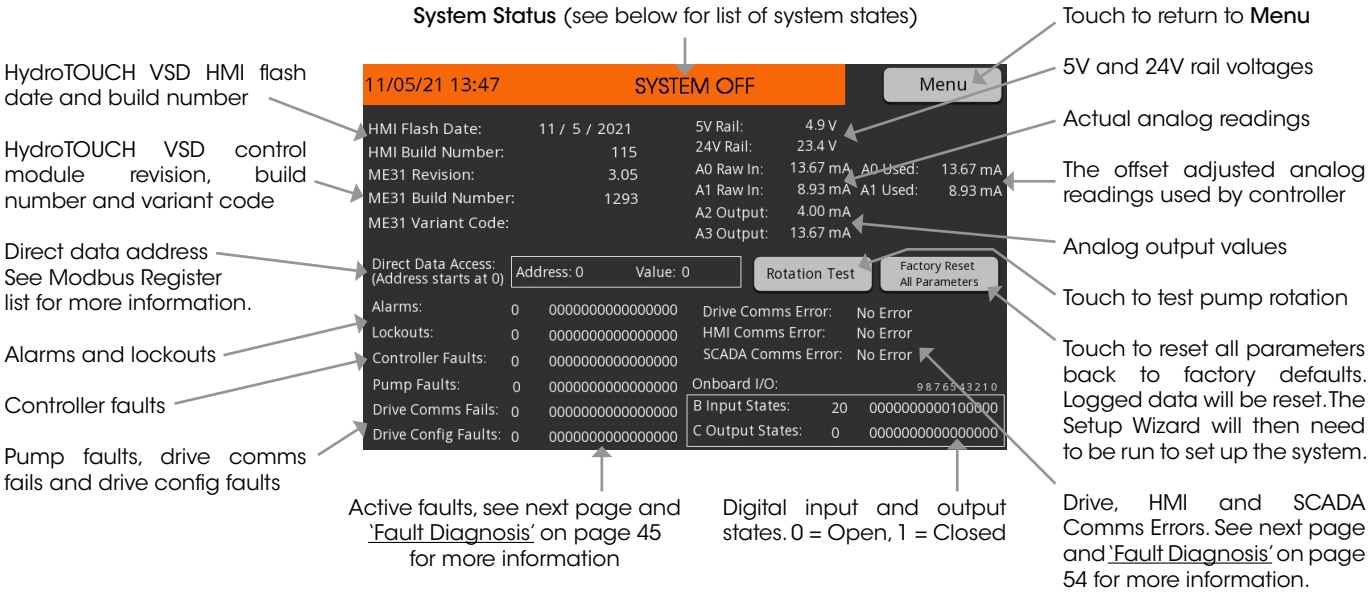
FAULT FINDING

If there is trouble communicating with the HydroTOUCH VSD controller, follow the below steps:

1. Try reading a single Modbus register using function code 03.
2. Check the connections and try swapping the A and B wires.
3. Check the SCADA fault codes under 'Diagnostics' on page 38 and check causes and remedied under 'Fault Diagnosis' on page 43 of this manual.
4. Turn the SCADA termination resistor on or off with the jumper bridge on the HydroTOUCH VSD module.
5. For specific fault finding see Fault Diagnosis' on page 43 of this manual.

DIAGNOSTICS

DIAGNOSTICS SCREEN



SYSTEM STATES

Initialisation	The system is setting up the configuration after a power failure before going into the powerup state.
Powerup	The system is powering up after power is switched on or the system is restarted.
Off	The system is turned off and will not run any pumps.
Startup	The system has woken from sleep and is configuring itself before going into the running state.
Setpoint Ramp	The system has woken from sleep and the pressure was low so a single pump will ramp smoothly to full speed before going to running mode.
Pipe Fill	The system has woken from sleep when the pressure was very low so a single pump will run at a fixed speed to increase pressure before going to running mode.
Running	The system is in auto and pumps are running and speed is set based on the PID algorithm.
Speed Minimise	The system is using the speed minimise sleep assist function to slow the pump speed down to attempt to put the pumps to sleep.
Stage	The system is not keeping up with demand and is starting an additional standby pump to assist.
Destage	The system demand has dropped and the system is shutting down a standby pump to meet the new demand.
Duty Change	The system is changing the duty pump according to the duty share settings.
Sleep Boost	The system is using the sleep boost assist function to increase pressure to attempt to put the pumps to sleep.
Sleep	The system is available for operation but not at the analog wakeup threshold and no digital start inputs are active.
System Lockout	The system has an active fault that is stopping the pumps from running in auto. The fault can been seen on the alarms page with a manual reset required once fault is fixed.
System Disabled	The system is disabled via the digital system enable input. If assigned and not in use this input must be bridged.
Forced Mains Water	The system is configured for mains water bypass and the tank is low or the system has an active lockout fault.
Pump Rotation Test	The pump rotation test has been initiated, cycling through each pump, running it slowly so that correct rotation can be checked.
Duty Destage	The system is destaging the main duty pump to return to the jacking pump as the duty pump.
Wizard	The system is being configured in the Setup Wizard.
Inhibit	The system has been inhibited by an auxiliary condition which when cleared will re-initiate the system. If a timer is displayed the system will automatically restart after the timer has finished the count down.

The fault values on the Diagnostic page are displayed in hexadecimal format which needs to be converted to binary to work out which faults are active. The easiest way is to enter the hexadecimal number into a hex to binary converter and then check the resultant binary bits, which are =1 against the tables below. Binary bit 0 is the right most digit (bit).
Example: HEX = C0 = 1100 = bit 6 and bit 7 are on = Low pressure fault and high level faults are active.

ALARMS & LOCKOUTS

Bit 0: A0 Input Fault
Bit 1: A1 Input Fault
Bit 2: High Level
Bit 3: Low Level
Bit 4: Prime Loss
Bit 5: High Pressure
Bit 6: Low Pressure
Bit 7: Pipe Fill Fail
Bit 8: Pump Cycle
Bit 9: Pump Fault
Bit 10: Drive Comms Fail
Bit 11: Drive Config Fault
Bit 12: No Pumps Available
Bit 13: No Feedback
Bit 14: Max Flow
Bit 15: UV 1

Bit 16: UV 2
Bit 17: Filter 1
Bit 18: Filter 2
Bit 19: Filter 1 Blocked
Bit 20: Filter 2 Blocked
Bit 21: Medium Level
Bit 22: Low Flow
Bit 23: High Flow
Bit 24: Low Temperature
Bit 25: High Temperature
Bit 26: Manual Override
Bit 27: Low Aux Temperature
Bit 28: High Aux Temperature
Bit 29: A0 Backup Discrepancy
Bit 30: A1 Backup Discrepancy
Bit 31: SCADA Watchdog Timeout

EXTENDED ALARMS

Bit 0: Low Aux Level
Bit 1: High Aux Level

Note - The extended alarms are not displayed on the diagnostics screen.

See 'Functions & Fault Protection' and 'Fault Diagnosis' on page 47 for further information

DRIVE, HMI & SCADA COMMS ERROR

Bit 0: No error
Bit 1: Serial port error
Bit 2: Receive timing error
Bit 3: Receive buffer overflow
Bit 4: Modbus CRC error
Bit 5: Modbus incorrect slave address
Bit 6: Modbus illegal function code
Bit 7: Modbus illegal data value
Bit 8: Modbus slave device failure
Bit 9: Response timeout error

See 'Fault Diagnosis' on page 43 or the **HydroTOUCH VSD Modbus Registers document** for further information

CONTROLLER FAULTS

Bit 0: EEPROM hardware fault
Bit 1: Data load
Bit 2: 5V power rail tolerance
Bit 3: 24V power rail tolerance
Bit 4: System watchdog reset
Bit 5: Data reinitialised
Bit 6: Data initialised
Bit 7: Bank 0 checksum
Bit 8: Bank 2 checksum
Bit 9: No EEPROM signature
Bit 10: EEPROM Parameter limits

See 'Fault Diagnosis' on page 43 for further information

PUMP FAULTS, DRIVE CONFIG FAULTS, DRIVE

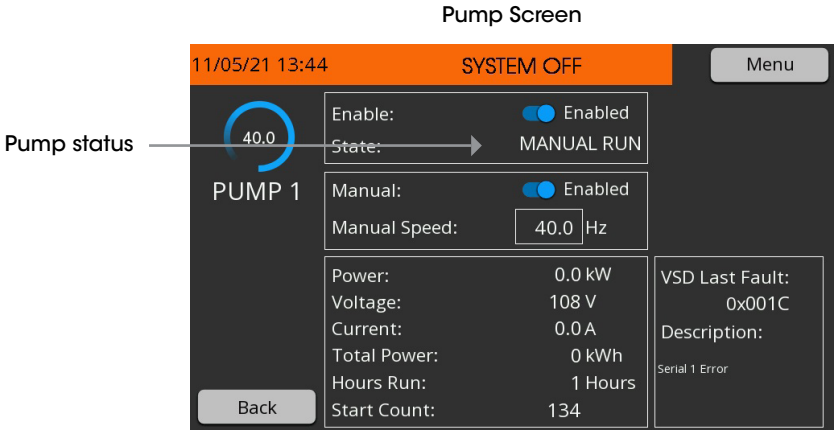
Bit 0: Pump 1	Pump 1 in fault
Bit 1: Pump 2	Pump 2 in fault
Bit 2: Pump 3	Pump 3 in fault
Bit 3: Pump 4	Pump 4 in fault
Bit 4: Pump 5	Pump 5 in fault
Bit 5: Pump 6	Pump 6 in fault
Bit 6: Pump 7	Pump 7 in fault
Bit 7: Pump 8	Pump 8 in fault
Bit 8: Pump 9	Pump 9 in fault
Bit 9: Pump 10	Pump 10 in fault
Bit 10: Pump 11	Pump 11 in fault
Bit 11: Pump 12	Pump 12 in fault

See 'Fault Diagnosis' on page 47 for further information

Note: For all bit states
0 = Not active
1 = Active

PUMP STATES

Pump Screen

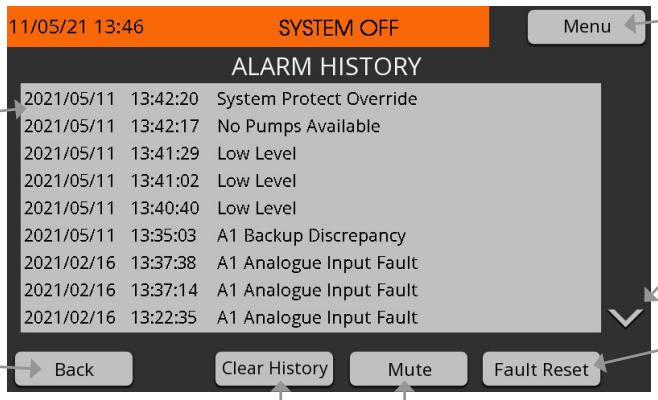


Off	Pump is off and will not run in auto or manual operation.
Disabled	Pump is disabled and will not run in auto or manual operation.
Manual Off	Pump is in manual but is not running due to other restrictions, if the system is in auto mode.
Manual Run	Pump is in manual and running.
Standby Idle	Pump is in auto, assigned as a standby pump and available to run.
Standby Run	Pump is in auto, assigned as a standby pump and is running.
Duty Idle	Pump is in auto, assigned as the duty pump and available to run.
Duty Run	Pump is in auto, assigned as the duty pump and is running.
New Duty Pump Run	On a duty pump alternation this pump will be the pump starting to take over the duty.
Test Run	Pump rotation test is running the pump slowly so it can be checked for correct rotation.
Drive Fault	The Variable Speed Drive has triggered a fault.The fault code and description displays in the bottom right corner.
Drive Comms Fail	No communication between the HydroTOUCH VSD and the drive.
Drive Config Fail	The Drive is receiving a run command but is not running, or incorrect pump motor data entered in the Setup Wizard, or the pump connected is too big for the drive.
Jacking Pump Idle	The pump is setup as a jacking pump to always start first and is available to run.
Jacking Pump Run	The pump is setup as a jacking pump to always start first and is running.

FAULT DIAGNOSIS

ALARMS SCREEN

List of all current and historical alarms.



Touch to return to **Menu**

Touch to scroll through older faults

Resets any latched faults. If an alarm will not clear or comes back the alarm condition is still active and needs to be rectified before resetting.

Touch to return to the main screen

Clears fault history

Mutes the audible alarm

FAULT CAUSES & REMEDIES

Fault	Cause	Remedy
Alarms, Fault Lockouts, Fault Inhibits & Drive Config Faults		
A0 Input Fault **A1 Input Fault**	Analog input reading is outside of the 4-20mA acceptable reading, possibly due to: • Transducer not connected. • Broken or loose connection. • Short circuit in transducer or cable.	• Check that the sensor is wired correctly. • Check that the sensor is passive 'loop powered'. • Replace the sensor if faulty.
High Level	The analog tank level value has gone above the *High level threshold* and/or the high level input has received a cosed contact for the fault delay, possibly due to: • High level float switch installed or wired incorrectly, or has malfunctioned. • *High level threshold* is set incorrectly. • System overshoot in level fill mode, possibly due to incorrect analog reading. • Pumps are unable to keep up with inflow into the tank/pit, in level empty mode.	• Inspect the level in the tank/pit. • Check that the *High level threshold* setting is set to a suitable value above the *setpoint* in the Setup Wizard. • Ensure the high level float switch is at the correct position in the tank/pit. • Ensure the high level float switch is wired as close on rise (typically black and brown wires are used). • If the tank/pit is not at high level, remove the high level float from the input and clear the fault. If the fault does not return, the float may be faulty. Replace if needed. • If the high level protection based on the analog input is not required, disable the *High level protection* in the Setup Wizard.
Low Level	The analog tank level has gone below the *Low level threshold* and/or the low level input has received an open contact for the fault delay, possibly due to: • Low level float switch installed or wired incorrectly, or has malfunctioned. • Incorrect settings entered in Setup Wizard. • System overshoot in level empty mode, possibly due to incorrect analog reading. • Pumps are unable to pump enough water into the tank/pit, in level fill mode.	• Inspect the level in the tank/pit. • Check that the *Low level threshold* setting is set to a suitable value below the *setpoint* in the Setup Wizard. • If the low level input is not in use, ensure it is bridged. • Ensure the low level float switch is at the correct position in the tank/pit. • Ensure the low level float switch is wired as close on rise (typically black and brown wires are used). • If the level in the tank/pit is not at low level, remove the low level float switch from the input and test. Replace if faulty. • If the low level protection based on the analog input is not required, disable the *Low level protection* in the Setup Wizard.
High Pressure	System pressure has gone above the *High pressure threshold* and/or the high pressure input has received an open contact for the fault delay, possibly due to: • System overshoot. • Incorrect settings entered in Setup Wizard. • System blockage or shut valve. • High pressure switch installed or wired incorrectly.	• Check that the *High pressure threshold* setting is set adequately above the *setpoint* in the Setup Wizard. • If the high pressure input is not used, ensure it is bridged. • Ensure the high pressure switch is wired as open on fault. • Test the high pressure switch. Replace if faulty. • Ensure the high pressure switch is installed correctly. • Investigate cause of high pressure event. • If the high pressure protection based on the analog input is not required, disable the *High pressure protection* in the Setup Wizard.

FAULT CAUSES & REMEDIES (CONTINUED)

Fault	Cause	Remedy
Low Pressure	System pressure has gone below the *Low pressure threshold* for the fault delay, possibly due to: • Incorrect settings entered in Setup Wizard. • Burst pipe. • Pump loss of prime. • Incorrect setup settings.	• Check that the *Low pressure threshold* setting is set adequately below the *setpoint* in the setup. • Investigate cause of low pressure event. • If the low pressure protection based on the analog input is not required, disable the *Low pressure protection* in the Setup Wizard.
Pipe Fill Fail	Running the pipe fill function but pump is unable to reach the *pipe fill threshold* distance from *setpoint* within the 10 minute timeout period, possibly due to: • Demand is greater than the pump output while pipe fill is operating. • A pipe has burst.	• If demand is frequently too high for the pipe fill function to operate correctly, either adjust the pipe fill settings or disable this function in the parameters list. • Inspect pipes for damage.
Pump Cycle	The system has gone to sleep and woken up within 5 seconds more than 10 times within an hour, possibly due to: • Insufficient sensor settings. • Poor wiring connections. • Leaks in pipe work for pressure systems.	• Inspect the pipe work for leaks. • Inspect pressure vessel for correct setting. • Ensure check valves are shutting upon entering sleep. • If the pump cycle protection is not required, disable it in the Setup Wizard.
Pump Fault (1-12)	A variable speed drive has triggered a fault, check the fault code on the VSD.	• See 'VSD Fault Diagnosis' on page 59 for more information on VSD fault causes and remedies.
Drive Comms Fail (1-12)	No communication between the HydroTOUCH VSD and the drive.	• Ensure the drive has power. • Check communication wires are connected correctly. • Reload drive settings from drive screen. • See 'Drive Communication' on page 18 for more information on the above points.
Drive Config Fault (1-12)	The drive is communicating with the HydroTOUCH VSD but not responding to the run command, possibly due to: • Drive modbus settings have been adjusted incorrectly • Drive has been put into local mode	• Check the drive settings. • Reload the drive settings from the drive screen. • Ensure the drive is in Auto or Remote.
No Pumps Available	There are no pumps available to operate.	• Ensure that pump faults are manually reset. • Ensure that the available pumps are not disabled.
No feedback lockout	There is no transducer available to operate the system, possibly due to: • Primary transducer not connected. • Broken or loose connection. • Short circuit in transducer or cable. • Both the primary and secondary/backup transducers have failed.	• Check primary transducer connections and the secondary/backup transducer connections, if in use. • Check that the sensor/s are passive 'loop powered' • Replace the sensor/s if faulty.
Max Flow	All available pumps have been running continuously at maximum speed for the *Max flow fault delay*, possibly due to: • Loss of prime. • No water available.	• Check the cause for all pumps running. If this is normal operation extend the *Max run fault delay* or disable the protection in the Setup Wizard. • Fix hydraulic faults.
UV1 **UV2**	The UV fault input has received an open/closed contact for the fault delay, possibly due to: • Incorrect settings entered in parameters list. • UV lamp faulty.	• Check if the UV lamp has a fault. • Ensure the fault active polarity is set correctly in the parameters list. • If the UV fault input is not required then unassign it.
Filter 1 **Filter 2**	The filter fault input has received an open/closed contact for the fault delay, possibly due to: • Incorrect settings entered in parameters list. • Filter faulty.	• Check if the filter has a fault. • Ensure the fault active polarity is set correctly in the parameters list. • If the filter fault input is not required then unassign it.
Filter 1 Blocked **Filter 2 Blocked**	The filter blocked input has received an open/closed contact for the fault delay, possibly due to: • Incorrect settings entered in parameters list. • Filter is blocked.	• Check if the filter is blocked. • Ensure the fault active polarity is set correctly in the parameters list. • If filter blocked input is not required then unassign it.

FAULT CAUSES & REMEDIES (CONTINUED)

Fault	Cause	Remedy
Medium Level	The analog tank level value has gone above/below the *Medium level threshold* and/or the medium level input has received an open/closed contact for the fault delay period, possibly due to: • Pumps unable to keep up with rising/falling level in the tank/pit. • Medium level float switch installed or wired incorrectly. • Medium level protection settings incorrect in the parameters list.	• Ensure the *medium level threshold* is entered correctly in the parameters list. • Check that the medium level float switch is wired as close on rise (typically black and brown wires). • Check that the medium level float switch is installed in the correct location in the tank/pit. • Check that the *Medium level alarm direction* is set correctly in the parameters list. • If the medium level protection is not required, ensure the *Medium level analog enable* is set to 'Disable' and the medium level input is unassigned in the parameters list. • Test the medium level float switch. Replace if faulty.
Low Flow	The flow rate has dropped below the *low flow threshold* or the low flow input has received an open contact for the fault delay period, possible due to: • Pulse meter installed or wired incorrectly. • Flow switch installed or wired incorrectly. • A pump not producing flow when called to run due to a loss of prime or stalled pump.	• Check that the *low flow threshold* setting is set correctly in the Setup Wizard. • Check that the flow switch is wired as open on fault. • Check that the flow switch or pulse meter is installed in the correct orientation and on the correct pipe. • If the flow switch or pulse meter input is not required, unassign it in the Setup Wizard. • Test the low flow switch. Replace if faulty. • Check the pump is adequately primed. • Check the pump is mechanically free.
High Flow	The flow rate has exceeded the *high flow threshold* or the high flow input has received a closed contact for the fault delay period, possibly due to: • Flow pulse meter installed or wired incorrectly • Flow switch installed or wired incorrectly. • System overshoot.	• Check that the *high flow threshold* setting is set correctly in the Setup Wizard. • If the high flow input is assigned but is not required, either unassign it or bridge the input. • Check that the flow switch is wired to close on fault. • Check that the flow switch or pulse meter is installed in the correct orientation and pipe for the pump or system. • Test the high flow switch. Replace if faulty.
Low Temperature	The analog temperature value has gone below the *Low temperature threshold* and/or the low temperature input has received an open contact for the fault delay period, possibly due to: • Low temperature thermostat installed or wired incorrectly. • Low temperature settings entered incorrectly in the Setup Wizard. • System overshoot in temperature cool mode. • Pumps unable to keep up with demand in temperature heat mode.	• Check that the *Low temperature threshold* setting is set correctly in the Setup Wizard. • If the low temperature input is assigned but is not required, either unassign it or bridge the input. • Ensure that the low temperature input is wired as open on fault. • Test the low temperature thermostat. Replace if faulty.
High Temperature	The analog temperature value has gone above the *High temperature threshold* and/or the high temperature input has received a closed contact for the delay period, possibly due to: • High temperature thermostat installed or wired incorrectly. • High temperature settings entered incorrectly in the Setup Wizard. • System overshoot in temperature heat mode. • Pumps unable to keep up with demand in temperature cool mode.	• Check that the *High temperature threshold* setting is set correctly in the Setup Wizard. • Ensure that the high temperature input is wired as close on fault. • Test the high temperature thermostat. Replace if faulty.
Manual Override	A pump has been placed into manual mode while system is in fault lockout, overriding system protections for 15 minutes.	• Return the pump back to off or auto if manual not required. • Wait for the manual timeout period of 15 minutes to finish.

FAULT CAUSES & REMEDIES (CONTINUED)

Fault	Cause	Remedy
Low Aux Temperature	The auxiliary analog temperature value has gone below the auxiliary *Low temperature threshold* and/or the auxiliary low temperature input has received an open contact for the fault delay period, possibly due to: • Auxiliary low temperature thermostat installed or wired incorrectly. • Auxiliary low temperature settings entered incorrectly in the Setup Wizard. • System overshoot in temperature cool mode. • Pumps unable to keep up with demand in temperature heat mode.	• Check that the auxiliary *Low temperature threshold* setting is set correctly in the Setup Wizard. • If the auxiliary low temperature input is assigned but is not required, either unassign it or bridge the input. • Ensure that the auxiliary low temperature input is wired as open on fault. • Test the auxiliary low temperature thermostat. Replace if faulty. • If not required, disable the *Low auxiliary temperature alarm* in the Setup Wizard.
High Aux Temperature	The auxiliary analog temperature value has gone above the auxiliary *High temperature threshold* and/or the auxiliary high temperature input has received a closed contact for the delay period, possibly due to: • Auxiliary high temperature thermostat installed or wired incorrectly. • Auxiliary high temperature settings entered incorrectly in the Setup Wizard. • System overshoot in temperature heat mode. • Pumps unable to keep up with demand in temperature cool mode.	• Check that the auxiliary *High temperature threshold* setting is set correctly in the Setup Wizard. • Ensure that the auxiliary high temperature input is wired as close on fault. • Test the auxiliary high temperature thermostat. Replace if faulty. • If not required, disable the *High auxiliary temperature alarm* in the Setup Wizard.
A0 Backup Discrepancy **A1 Backup Discrepancy**	The difference between the primary and secondary transducer readings has exceeded the *max transducer difference* for the *fault delay*. System is now operating based off the transducer with reading furthest above or below the *setpoint*, depending on the control direction.	• Check the primary and secondary transducer connections. • Check sensors are passive 'loop powered' • Replace one sensor if faulty.
High Auxiliary Level	The auxiliary analog tank level value has gone above the auxiliary high level threshold and/or the auxiliary high level input has received a cosed contact for the fault delay, possibly due to: • Auxiliary high level float switch installed or wired incorrectly, or has malfunctioned. • Auxiliary *High level threshold* is set incorrectly. • The level in the auxiliary supply or destination tank has reached high level.	• Inspect the level in the auxiliary tank/pit. • Check that the auxiliary *fault analog level* setting is set to a suitable value in the parameters list. • Ensure the auxiliary high level float switch is at the correct position in the auxiliary tank/pit. • Ensure the auxiliary high level float switch is wired as close on rise (typically black and brown wires). • If the auxiliary tank/pit is not at high level, remove the auxiliary high level switch from the input and rest the fault. If the fault does not return the float may be faulty. Replace if needed. • If the auxiliary high level protection based on the analog input is not required, disable the *Fault analog enable* in the parameters list.
Low Auxiliary Level	The auxiliary analog tank level has gone below the auxiliary low level threshold and/or the auxiliary low level input has received an open contact for the fault delay, possibly due to: • Auxiliary low level float switch installed or wired incorrectly, or has malfunctioned. • Incorrect settings entered in Setup Wizard. • The level in the auxiliary supply or destination tank has reached low level.	• Inspect the level in the auxiliary tank/pit. • Check that the auxiliary *fault analog level* setting is set to a suitable value in the parameters list. • If the auxiliary low level input is assigned but not in use, either unassign it or bridge the input. • Ensure the auxiliary low level float switch is at the correct position in the auxiliary tank/pit. • Ensure the auxiliary low level float switch is wired as close on rise (typically black and brown wires). • Remove the low level float switch from the input and test. Replace if faulty. • If the auxiliary low level protection based on the auxiliary analog input is not required, disable the *Fault analog enable* in the parameters list.

FAULT CAUSES & REMEDIES (CONTINUED)

Controller Faults		
EEPROM hardware fault	Internal controller fault - Failure with the EEPROM memory.	• Contact MATelec Australia for support
Data load	Internal controller fault - Data has not loaded correctly out of EEPROM to be used for operation.	• Contact MATelec Australia for support
5V power rail tolerance	Internal controller fault - A power supply issue with the internal 5V supply.	• Contact MATelec Australia for support
24V power rail tolerance	Internal controller fault - A power supply issue with the external 24V supply.	• Inspect 24Vdc power supply is at correct voltage and replace if necessary, contact MATelec Australia for support if external power supply is working correctly.
Data reinitialised	Internal controller fault - A data fault has occurred causing the data settings to be set back to defaults.	• Reset controller back to factory defaults and setup again. If issue persists contact MATelec Australia for support.
Data initialised	Internal controller fault - Initial data configuration, this alarm should only display momentarily.	• If fault persists contact MATelec Australia for support
Bank 0 checksum	Internal controller fault - Internal data corruption with primary data.	• Controller should run off the backup data, reset the fault and if fault persists contact MATelec Australia for support.
Bank 2 checksum	Internal controller fault - Internal data corruption with backup data.	• Controller should run off the primary data, reset the fault and if fault persists contact MATelec Australia for support.
EEPROM no signature	Internal controller fault - Issue with EEPROM memory signature.	• Contact MATelec Australia for support
SCADA Comms Error		
Scada Watchdog	The watchdog reset (keep alive) register 967 has not been written to 1 within the watchdog timeout period.	• Setup continual polled write =1 to modbus register 967 at a frequency shorter than the SCADA watchdog period • Disable the SCADA watchdog in the setup if not required
SCADA UART error	Data packets not being received correctly	• Confirm baud rate and number of bits. • Ensure that RS-485 connections are correct
SCADA Receive timing error	Signals from the Modbus master are being received before the HydroTOUCH VSD slave is ready to receive them.	• Check the baud rate is the same on the master and the slave. • Increase the time between modbus packets
SCADA receive overflow error	Too many bytes have been received by the HydroTOUCH VSD slave exceeding the receive buffer.	• Check the parity stop bit • Increase the time between modbus packets • Check the framing of the modbus packet is correct
SCADA CRC Error	Modbus checksum does not equal the data in the packet.	• Check Modbus baud rate and parity settings • Check cable route and shield earthing for potential sources of interference
SCADA Incorrect Modbus slave	Slave number was not an acceptable ID number.	• Check the slave ID number used is the same as the HydroTOUCH VSD SCADA slave ID parameter
SCADA Illegal modbus function code	Function code is not a permissible function code for this controller	• See 'SCADA Communication' on page 46 for permissible function codes.
SCADA Illegal Modbus address	Address used is not available or may be read or write only.	• Check the address is an available address • Check that the register is not out by + or - 1 • Check that Master Modbus reads are reading readable registers and writing to writable registers
SCADA Illegal Modbus data value	The value of a Modbus write is outside of the acceptable range.	• Check the value is in an acceptable range for the register being written to. Ranges are listed in the **HydroTOUCH VSD Modbus Registers** document.
SCADA Modbus slave device failure	There has been an internal fault with the HydroTOUCH VSD Modbus port.	• Try power cycling the HydroTOUCH VSD module. • If fault persists then a replacement module may be required.

VSD FAULT DIAGNOSIS

ABB ACS180 DRIVE FAULTS

Code	Fault / Aux. code	Cause	Remedy
2310	Overcurrent	Output current has exceeded internal fault limit. In addition to an actual overcurrent situation, this fault may also be caused by an earth fault or supply phase loss.	Check motor load. Check acceleration times in parameter group *23 Speed reference ramp* (speed control), *26 Torque reference chain* (torque control) or *28 Frequency reference chain* (frequency control). Also check parameters *46.01 Speed scaling, 46.02 Frequency scaling* and *46.03 Torque scaling.* Check motor and motor cable (including phasing and delta/star connection). Check there are no contactors opening and closing in motor cable. Check that the start-up data in parameter group *99 Motor data* corresponds to the motor rating plate. Check that there are no power factor correction capacitors or surge absorbers in motor cable. Check for an earth fault in motor or motor cables by measuring the insulation resistances of motor and motor cable.
2340	Short circuit	Short-circuit in motor cable(s) or motor. Aux code 0x0080 indicates that the state feedback from output phases does not match the control signals.	Check motor and motor cable for cabling errors. Check there are no power factor correction capacitors or surge absorbers in motor cable. Cycle the power to the drive.
3130	Input phase loss	Intermediate circuit DC voltage is oscillating due to missing input power line phase or blown fuse.	Check input power line fuses. Check for loose power cable connections. Check for input power supply imbalance.
3210	DC link overvoltage	Excessive intermediate circuit DC voltage.	Check that overvoltage control is on (parameter *30.30 Overvoltage control*). Check that the supply voltage matches the nominal input voltage of the drive. Check the supply line for static or transient overvoltage. Check deceleration time. Use coast-to-stop function (if applicable). Retrofit drive with brake chopper and brake resistor. Check that the brake resistor is dimensioned properly and the resistance is between acceptable range for the drive.
3220	DC link undervoltage	Intermediate circuit DC voltage is not sufficient because of a missing supply phase, blown fuse or fault in the rectifier bridge.	Check supply cabling, fuses and switchgear.
3381	Output phase loss Programmable fault: *31.19 Motor phase loss*	Motor circuit fault due to missing motor connection (any of the three phases not connected). In scalar control mode, the drive detects fault only when the output frequency is above 10% of the motor nominal frequency.	Connect motor cable. If the drive is in scalar mode and nominal current of the motor is less than 1/6 of the nominal output current of the drive, set parameter *31.19 Motor phase loss* to *No action*.
4110	Control board temperature	Control board temperature is too high.	Check proper cooling of the drive. Check the auxiliary cooling fan.
4290	Cooling	Drive module temperature is excessive.	Check ambient temperature. If it exceeds 50 °C /122 °F, ensure that load current does not exceed derated load capacity of drive. See chapter *Technical data*, section *Derating* in the hardware manual of the drive. Check drive module cooling air flow and fan operation. Check inside of cabinet and heatsink of drive module for dust pick-up. Clean whenever necessary.

ABB ACS180 ABB DRIVE FAULTS (CONTINUED)

Code	Fault / Aux. code	Cause	Remedy
4310	Excess temperature	Power unit module temperature is excessive.	Check ambient conditions. Check air flow and fan operation. Check heatsink fins for dust pick-up. Check motor power against drive power.
5091	Safe torque off Programmable fault:*31.22 STO indication run/stop*	Safe torque off function is active, ie. safety circuit signal(s) connected to connector STO is broken during start or run.	Check safety circuit connections. For more information, see chapter *The Safe torque off function* in the hardware manual of the drive and description of parameter *31.22 STO indication run/stop*.
6681	EFB comm loss Programmable fault: *58.14 Communication loss action*	Communication break in embedded fieldbus (EFB) communication.	Check the status of the fieldbus master (online/offline/error etc.). Check cable connections to the EIA-485 terminals 25, 26, 27 and 28 on the control unit.
7122	Motor overload	Motor current is too high.	Check the motor, and the machinery coupled to motor, for overload. Adjust the parameters used for the motor overload function (*35.51...35.53*) and *35.55...35.56*.
7310	Overspeed	Motor is turning faster than highest allowed speed due to incorrectly set minimum/maximum speed, insufficient braking torque or changes in load when using torque reference.	Check minimum/maximum speed settings, parameters *30.11 Minimum speed* and *30.12 Maximum speed*. Check adequacy of motor braking torque. Check applicability of torque control. Check need for brake chopper and resistor(s).
73F0	Overfrequency	Maximum allowed output frequency exceeded.	Check minimum/maximum frequency settings, parameters *30.13 Minimum frequency* and *30.14 Maximum frequency*. Check adequacy of motor braking torque. Check applicability of torque control. Check need for brake chopper and resistor(s).
9081	External fault 1 (Editable message text) Programmable fault: *31.01 External event 1 source* *31.02 External event 1 source*	Fault in external device 1.	Check the external device. Check setting of parameter *31.01 External event 1 source*.
FA81	Safe torque off 1	Safe torque off function is active, ie. STO circuit 1 is broken.	Check safety circuit connections. For more information, see chapter *The Safe torque off function* in the hardware manual of the drive and description of parameter *31.22 STO indication run/stop* (page *216*).
FA82	Safe torque off 2	Safe torque off function is active, ie. STO circuit 2 is broken.	

For any other faults, see the ABB ACS310 VSD manual.

DANFOSS VLT-51 DRIVE FAULTS

The Danfoss drives have 3 levels of alarm protection; warning, fault and trip lock. A warning (yellow indicator) activates an alarm but allows the drive to maintain operation. A fault (flashing red indicator) activates an alarm and also trips the drive to stop operating, requiring a reset. A trip lock is a fault with the added protection, requiring the mains supply be switched off before the alarm can be reset. After being switched back on, the drive is no longer blocked and may be reset once the cause has been rectified. Alarms that are not trip-locked are reset using the reset on the touchscreen.

Code	Fault	Cause	Remedy
AL2	Live zero error	Signal on terminal 53 or 60 is less than 50% of value set in 6-10 Terminal 53 Low Voltage, 6-12 Terminal 53 Low Current and 6-22 Terminal 60 Low Current.	
AL4	Main phase loss	A phase is missing on the supply side, or the mains voltage imbalance is too high. This message also appears for a fault in the input rectifier on the frequency converter.	Check the supply voltage and supply currents to the frequency converter. The fault may be caused by mains distortions. Installing Danfoss Line Filter may rectify this problem.
AL7	DC over voltage	If the intermediate circuit voltage exceeds the limit, the frequency converter trips after a time.	• Connect a brake resistor • Extend the ramp time • Change the ramp type • Activate the functions in 2-10 Brake Function • Increase 14-26 Trip Delay at Inverter Fault • The fault may be caused by mains distortions. Installing Danfoss Line Filter may rectify this problem.
AL8	DC under voltage	If the intermediate circuit voltage (DC link) drops below the under voltage limit, the frequency converter checks if a 24 V DC backup supply is connected. If no 24 V DC backup supply is connected, the frequency converter trips after a fixed time delay. The time delay varies with unit size.	• Check that the supply voltage matches the frequency converter voltage. • Perform input voltage test. • Perform soft charge circuit test.
AL9	Inverter overload	The frequency converter is about to cut out because of an overload (too high current for too long). The counter for electronic, thermal inverter protection issues a warning at 98% and trips at 100%, while giving an alarm. The frequency converter cannot be reset until the counter is below 90%. The fault is that the frequency converter has run with more than 100% overload for too long.	• Compare the output current shown on the LCP with the frequency converter rated current. • Compare the output current shown on the LCP with measured motor current. • Display the Thermal Drive Load on the LCP and monitor the value. When running above the frequency converter continuous current rating, the counter increases. • When running below the frequency converter continuous current rating, the counter decreases.
AL10	Motor over Load temperature	According to the electronic thermal protection (ETR), the motor is too hot. Select whether the frequency converter gives a warning or an alarm when the counter reaches 100% in 1-90 Motor Thermal Protection. The fault occurs when the motor is overloaded by more than 100% for too long.	• Check for motor overheating. • Check if the motor is mechanically overloaded • Check that the motor current set in 1-24 Motor Current is correct. • Ensure that Motor data in parameters 1-20 through 1-25 are set correctly. • Running AMT in 1-29 Automatic Motor Tuning • (AMT). The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12 s, then the frequency converter trips and issues an alarm. • Turn off the frequency converter and check if the motor shaft can be turned and if the motor size matches the frequency converter. If extended mechanical brake control is selected, trip can be reset externally. May tune the frequency converter to the motor more accurately and reduce thermal loading.
AL11	Motor Thermistor over temp	The thermistor might be disconnected. Select whether the frequency converter gives a warning or an alarm in 1-90 Motor Thermal Protection.	• Check for motor overheating. • Check if the motor is mechanically overloaded.

DANFOSS VLT-51 DRIVE FAULTS (CONTINUED)

Code	Fault	Cause	Remedy
AL13	Over current	The inverter peak current limit (approx. 200% of the rated current) is exceeded. The warning will last approx. 8-12s, then the frequency converter trips and issues an alarm. Turn off the frequency converter and check if the motor shaft can be turned and if the motor size matches the frequency converter. If extended mechanical brake control is selected, trip can be reset externally.	• Remove power and check if the motor shaft can be turned. • Check that the motor size matches the frequency converter. • Check parameters 1-20 through 1-25 for correct motor data.
AL14	Earth (ground) fault	There is current from the output phases to earth, either in the cable between the frequency converter and the motor or in the motor itself.	• Remove power to the frequency converter and repair the earth fault. • Check for earth faults in the motor by measuring the resistance to ground of the motor leads and the motor with a megohmmeter.
AL16	Short circuit	There is short-circuiting in the motor or motor wiring.	• Remove power to the frequency converter and repair the short circuit.
AL17	Control word timeout	There is no communication to the frequency converter. The warning is only active when 8-04 Control Word Timeout Function is NOT set to OFF. If 8-04 Control Word Timeout Function is set to Stop and Trip, a warning appears and the frequency converter ramps down until it trips, while giving an alarm. 8-03 Control Timeout Time could possibly be increased.	• Check connections on the serial communication cable. • Increase 8-03 Control Word Timeout Time • Check the operation of the communication equipment. • Verify a proper installation based on EMC requirements.
AL25	Brake resistor short circuit	The brake resistor is monitored during operation. If a short circuit occurs, the brake function is disabled and the warning appears. The frequency converter is still operational but without the brake function.	• Remove power to the frequency converter and replace the brake resistor (see 2-15 Brake Check).
AL27	Brake chopper fault	The brake transistor is monitored during operation and if a short circuit occurs, the brake function is disabled and a warning is issued. The frequency converter is still operational but, since the brake transistor has shortcircuited, substantial power is transmitted to the brake resistor, even if it is inactive.	• Remove power to the frequency converter and remove the brake resistor
AL28	Brake check failed	The brake resistor is not connected or not working.	
AL29	Heatsink temp	The maximum temperature of the heatsink has been exceeded. The temperature fault will not reset until the temperature falls below a defined heatsink temperature. The trip and reset points are different based on the frequency converter power size.	• Check for the following conditions. • Ambient temperature too high. • Motor cable too long. • Incorrect airflow clearance above and below the frequency converter. • Blocked airflow around the frequency converter. • Damaged heatsink fan. • Dirty heatsink.
AL30	Motor phase U missing	Motor phase U between the frequency converter and the motor is missing.	• Remove power from the frequency converter and check motor phase U.
AL31	Motor phase V missing	Motor phase V between the frequency converter and the motor is missing.	• Remove power from the frequency converter and check motor phase V.
AL32	Motor phase W missing	Motor phase W between the frequency converter and the motor is missing.	• Remove power from the frequency converter and check motor phase W.
AL38	Internal fault	Internal fault	• Cycle power • Check that the option is properly installed • Check for loose or missing wiring • It may be necessary to contact MATelec Australia. • Note the code number for further troubleshooting directions.

DANFOSS VLT-51 DRIVE FAULTS (CONTINUED)

Code	Fault	Cause	Remedy
AL47	24V supply low	The 24 V DC is measured on the control card.	• The external 24 V DC backup power supply may be overloaded, otherwise contact the MATelec Australia.
AL51	AMT check Unom and Inom	The settings for motor voltage, motor current, and motor power are wrong.	• Check the settings in parameters 1-20 to 1-25.
AL55	AMA parameter out of range	The parameter values of the motor are outside of the acceptable range.	
AL63	Mechanical brake low	The actual motor current has not exceeded the "release brake" current within the "Start delay" time window.	
AL80	Drive initialised to default value	Parameter settings are initialised to default settings after a manual reset.	• Reset the unit to clear the alarm.
AL84	The connection between drive and LCP is lost	The connection between drive and LCP is lost	• Try to reassemble the LCP gently.
AL85	Button disabled	Button disabled	• See parameter group 0-4* LCP
AL86	Copy fail	An error occurred while copying from frequency converter to LCP or vice versa.	
AL87	LCP data invalid	Occurs when copying from LCP if the LCP contains erroneous data - or if no data was uploaded to the LCP.	
AL88	LCP data not compatible	Occurs when copying from LCP if data are moved between frequency converters with major differences in software versions.	
AL89	Parameter read only	Occurs when trying to write to a read-only parameter.	
AL90	Parameter database busy	Parameter database busy.	
AL91	Parameter value is not valid in this mode	Occurs when trying to write an illegal value to a parameter.	
AL92	Parameter value exceeds the min/max limits	Occurs when trying to set a value outside the range.	• Parameter can only be changed when the motor is stopped. Err. A wrong password was entered, occurs when using a wrong password for changing a password protected parameter.

See Danfoss VLT51 programming guide for further details.

LENZE DRIVE FAULTS

Code	Fault	Keypad display	Error type/ Response	Cause	Remedy
8784 0x2250	CIA: Continuous over current (internal)	PU over current	Fault The inverter is inhibited immediately. The motor becomes torqueless (coasts). The error can only be reset after a blocking time (5 sec).	• Continuous overcurrent on the inverter/motor side • Overcurrent at the brake chopper (brake transistor) • DC bus relay has not been closed due to a malfunction	• Check motor and wiring for short circuits • Check brake resistor and wiring
8892 0x2320	CIA: Short circuit/ earth leakage (internal)	Earth leak	Fault The inverter is inhibited immediately. The motor becomes torqueless (coasts). The error can only be reset after a blocking time (5 sec).	• Short circuit/earth fault of motor cable • Capacitive charging current of the motor cable too high	• Check motor cable • Check length of motor cable • User shorter or lower capacitance motor cable
9024 0x2340	CiA: Short circuit (device internal)	Motor shorted	Fault The inverter is inhibited immediately. The motor becomes torqueless (coasts). The error can only be reset after a blocking time (5 sec).	Short circuit of motor cable	• Check motor cable for short circuit
9040 0x2350	CiA: i^2*t overload (thermal state)	i2t motor	Fault (configurable) The error can only be reset after a blocking time (5 sec). Setting parameters: 0x2D4B:003	Motor thermally overloaded, e.g. by an impermissible continuous current or by frequent or too long acceleration processes.	• Check drive dimensioning • Check machine/ driven mechanics for excessive load
9090 0x2382	I*t error	Ixt error	Fault (configurable) The error can only be reset after a blocking time (3 sec). Setting parameters: 0x2D40:005	Device utilisation (I*t) too high by frequent and too long acceleration processes.	• Check drive dimensioning
9091 0x2383	I*t warning	Ixt warning	Warning	Device utilisation (I*t) too high by frequent and too long acceleration processes.	• Check drive dimensioning
9095 0x2387	Imax: Clamp responded too often	Clamp timeout	Fault	Maximum current of the axis (display in ox2DDF:002) has been reached too often in succession.	• Select a flatter speed ramp • Reduce the load • Set imax controller more dynamically
9096 0x2388	SL-PSM stall detection active	SL-PSM stall det.	Trouble The inverter is inhibited immediately. The motor becomes torqueless.	Overload of the motor with sensorless control for synchronous motors (SL-PSM).	• Reduce load at the axis • Check settings of the SL-PSM parameters
9098 0x238A	Maximum current reached	Imax reached	Information	The current motor current 0x6078 is equal to or higher than the max. overload current 0x6073	• Reduce the load on the motor or change the settings for the maximum overload current 0x6073
12576 0x3120	Mains phase fault	Mains Phase fail	Fault	Mains phase failure	• Check wiring of the mains connection • Check fuses

LENZE DRIVE FAULTS (CONTINUED)

Code	Fault	Keypad display	Error type/ Response	Cause	Remedy
12672 0x3180	UPS operation active	UPS oper. active	Warning	Operation on uninterrupted 1x230V current supply has been activated: Only a reduced output current is provided.	• Switch back to operation with regular mains voltage
12816 0x3210	DC bus overvoltage	DC Bus OV	Fault	DC-bus voltage has exceeded the error threshold for overvoltage due to a too high braking energy or a too high mains voltage. The error threshold (display in 0x2540:006) results from the setting of the rated mains voltage in 0x2540:001.	• Reduce dynamic performance of the load profile • Check mains voltage • Check settings for brake energy management • Connect brake resistor to the power unit and activate the integrated brake chopper
12817 0x3211	DC bus overvoltage warning	Warn.DC Bus OV	Warning	DC-bus voltage has exceeded the warning threshold for overvoltage set in 0x2540:005 due to a too high braking energy or a too high mains voltage.	• Reduce dynamic performance of the load profile • Check mains voltage • Check settings for brake energy management • Connect brake resistor to the power unit and activate the integrated brake chopper
12832 0x3220	DC bus underovervoltage	DC Bus UV	Trouble	DC-bus voltage has fallen below the error threshold for undervoltage. The error threshold (display in 0x2540:003) results from the setting of the rated mains voltage in 0x2540:001.	• Check mains voltage. • Check DC-bus voltage. • Check mains settings.
12833 0x3221	DC bus underovervoltage warning	Warn.DC Bus UV	Warning	DC-bus voltage has fallen below the warning threshold for undervoltage set in 0x2540:002.	• Check mains voltage. • Check DC-bus voltage. • Check mains settings.
12834 0x3222	DC-bus voltage to low for power up	DC-bus on-UV	Warning	The input voltage is too low to switch on the inverter.	• Check mains voltage. • Check mains settings.
16912 0x4210	PU: overtemperature fault	PU Overtemp.	Fault	The heatsink temperature of the power unit (display in 0x2D84:001) has exceeded the fixed error threshold (100 °C). • Ambient temperature too high. • Fan or ventilation slots are polluted. • Fan is defective.	• Provide for a sufficient cooling of the device. • Clean fan and ventilation slots. • If required, replace fan.
17024 0x4280	Heat sink temperature sensor fault	Heatsink sensor	Fault	Sensor for the temperature monitoring of the power unit is defective. The failure of the temperature monitoring function poses the risk of overheating!	• Hardware error: it is necessary to contact the manufacturer, since the device must be replaced.
17025 0x4281	Heat sink fan warning	Heatsink fan	Warning	Warning of the heatsink fan.	• Check/replace the heatsink fan.

LENZE DRIVE FAULTS (CONTINUED)

Code	Fault	Keypad display	Error type/ Response	Cause	Remedy
17029 0x4285	PU overtemperature warning	Warn.PU Overtemp	Warning	The heatsink temperature of the power unit (display in 0x2D84:001) has exceeded the warning threshold set in 0x2D84:002. • Ambient temperature too high. • Fan or ventilation slots are polluted. • Fan is defective.	• Provide for a sufficient cooling of the device. • Clean fan and ventilation slots. • If required, replace fan.
17168 0x4310	Motor temperature error	Overtemp. motor	Fault (Configurable) The error can only be reset after a blocking time (5 sec). Setting parameters: 0x2D49:002	The motor temperature sensor connected to terminals X109/T1 and X109/T2 measures a too high motor temperature. • Motor too hot by impermissibly high currents. • Motor too hot by frequent and too long acceleration processes.	• Check drive dimensioning. • Check motor temperature sensor and wiring.
20754 0x5112	24 V supply critical	24V supply low	Warning	24V voltage failed or too low.	• Check optional external 24V voltage supply (terminal X3/24E), if connected. • Check mains voltage.
20864 0x5180	Overload 24 V supply	Overload 24V	Warning	Output current at the 24V output or at the digital outputs too high.	• Check 24V output and digital outputs for earth fault or overload.
21376 0x5380	OEM hardware incompatible	Incomp. OEM HW	Fault The inverter is inhibited immediately. The motor becomes torqueless (coasts). The error can only be reset by mains switching.	The control unit (OEM hardware) is not compatible with the power unit (OEM hardware).	• Use compatible hardware. • Contact the OEM.
24970 0x618A	Internal fan warning	Internal fan	Warning	Warning of the internal fan.	• Check/replace internal fan.
25216 0x6280	Trigger/functions connected incorrectly	P400 config err	Trouble	The assignment directives have not been observed. • If the "flexible I/O configuration" is active as control source, the "Enable inverter" or "Run" function must be connected to a digital input in order that the motor can be stopped again any time! • The use of the "Start forward (CW)" and "Start reverse (CCW)" functions excludes the use of the "Run forward (CW)" and "Run reverse (CCW)" functions, and vice versa.	Check and correct the assignment of the triggers for the functions. • With keypad or network control, the two functions "Enable inverter" and "Run" can also be set to "Constant TRUE [1]" to start the motor.

LENZE DRIVE FAULTS (CONTINUED)

Code	Fault	Keypad display	Error type/ Response	Cause	Remedy
25217 0x6281	User-defined fault 1	User fault 1	Fault	Flexible I/O configuration: the "Activate fault 1" function was activated via the trigger selected in 0x2631:043.	• Eliminate error cause and then reset error.
25218 0x6282	User-defined fault 2	User fault 2	Fault	Flexible I/O configuration: the "Activate fault 2" function was activated via the trigger selected in 0x2631:044.	• Eliminate error cause and then reset error.
25232 0x6290	Warning invert rotation	Invert rotation	Warning The motor is brought to a standstill, since a reversal of the rotating direction is not permissible	• Negative setpoint selection with an active limitation of rotation 0x283A. • The "Reverse rotational direction" 0x2631:013 function was requested with an active limitation of rotation 0x283A.	• Check setpoint selection and trigger. • Check setting in 0x283A.
25233 0x6291	Maximum allowed troubles exceeded	Trouble overflow	Fault The motor remains at a standstill, no automatic restart is executed.	The number of permitted restart attempts after a fault set in 0x2839:003 was exceeded. The fault occurred to frequently and could not be reset.	• Check and the eliminate the fault.
25505 0x63A1	CU: load error ID tag	CU ID tag error	Fault The inverter is inhibited immediately. The motor becomes torqueless (coast). The error can only be reset by mains switching.	Calibration data of the control unit not compatible or faulty.	• Update firmware of the inverter to the most recent version. • If the error persist, the control unit or the device has to be replaced. In this case, please contact the manufacturer.
25506 0x63A2	PU: load error ID tag	PU ID tag error	Calibration data of the control unit not compatible or faulty.		
28801 0x7081	Analog input 1 fault	AI1 fault	Fault (Configurable) Setting parameters: 0x2636:010 (P430.10)	The monitoring function of the input signal configured for analog input 1 in 0x2636:008 and 0x2636:009 has been triggered.	• Check input signal at analog input 1. • Check configuration of the monitoring function.
28802 0x7082	Analog input 2 fault	AI2 fault	Fault (Configurable) Setting parameters: 0x2637:010	The monitoring function of the input signal configured for analog input 2 in 0x2637:008 and 0x2637:009 has been triggered.	• Check input signal at analog input 2. • Check configuration of the monitoring function.
29056 0x7180	Motor overcurrent	Mot max current	Fault (Configurable) The error can only be reset after a blocking time (1 sec) Setting parameters: 0x2D46:002	The motor current has exceeded the warning/ error threshold for the motor current monitoring set in 0x2D46:001	• Check motor load. • Check drive dimensioning. • Check warning threshold or error threshold set in 0x2D46:001
29573 0x7385	Feedback system: speed limit	F.fdb spd limit	Warning	The feedback system exceeds the maximum permissible frequency range of the digital inputs.	• Check feedback system.
33185 0x81A1	Modbus: network time-out	Modbus time-out	Fault (Configurable) Setting parameters: 0x2858:001	No valid messages have been received via the Modbus for a longer time than the timeout time set in 0x2858:002	• Check communication with the master. • Check wiring. • Check bus termination.

LENZE DRIVE FAULTS (CONTINUED)

Code	Fault	Keypad display	Error type/ Response	Cause	Remedy
33186 0x81A2	Modbus: incorrect request by master	Modbus request	Warning The inverter (slave) responds to the master with an error code: • 0x01 = invalid function code • 0x02 = invalid data address • 0x03 = invalid data value • 0x04 = slave device failure	The request by the master is invalid, e.g. invalid CRC checksum, non-supported function code, or impermissible data access.	Check request by the master: • Value in the valid range? • Function code valid? • No impermissible write access? (e.g. with regard to read-only parameters)
33553 0x8311	Torque limit reached	Torque limit	No response (Configurable) Setting parameters: 0x2D67:001	Motor has reached the torque limit: • 0x2949:003: Actual positive torque limit • 0x2949:004: Actual negative torque limit	• Observe load requirements. • Reduce motor load. • Check set torque limits and sources for the torque limits.
33664 0x8380	Function not allowed in selected operating mode	Func. n. allowed	Warning	The selected function is not permissible in the chosen operating mode. • Selection of torque mode [-1] in 40x6060 with incompatible motor control in 40x2C00. • Selection of invalid drive mode [0] in 40x6060.	• Note: selection of torque mode [-1] in 40x6060 with incompatible motor control in 40x2C00. • Check settings of operation modes.
36992 0x9080	Keypad removed	Keypad removed	Fault	The keypad was removed while the keypad control was activated.	• Plug keypad back in or activate another control source.
65282 0xFF02	Brake resistor: overload fault	BrkResistor OL.F	Fault (Configurable) The error can only be reset after a blocking time (5 sec). Setting parameters: 0x2550:011	The calculated thermal load of the brake resistor has reached the error threshold set in 0x2550:009. The regenerative energy is too high.	• Check drive dimensioning. • Check settings for the brake energy management. • Note: The error status will be reset if the thermal load falls below the error threshold - 20 %.
65285 0xFF05	Safe Torque Off is locked	STO locked	Fault The inverter is inhibited immediately. The motor becomes torqueless (coasts). The error can only be reset by mains switching.	The safety module or safety circuit of the device was detected as being defective.	• Hardware error: it is necessary to contact the manufacturer since the device must be replaced.
65286 0xFF06 0xFF06	Motor overspeed	Motor overspeed	Fault (Configurable) The error can only be reset after a blocking time (1 sec). Setting parameters: 0x2D44:002 (P350.02)	The motor speed has reached the error threshold for overspeed set in 0x2D44:001.	• Check application.
65289 0xFF09	Motor phase missing	Mot.Phase miss.	No response (Configurable) The error can only be reset after a blocking time (2 sec). Setting parameters: 0x2D45:001 (P310.01)	A failure of several motor phases has been detected.	• Check wiring between inverter and motor. • In case of a false tripping, adapt the settings for the motor phase failure detection.

LENZE DRIVE FAULTS (CONTINUED)

Code	Fault	Keypad display	Error type/ Response	Cause	Remedy
65290 0xFF0A	Motor phase failure phase U	Phase U failure	No response (Configurable) The error can only be reset after a blocking time (2 sec). Setting parameters: 0x2D45:001	A failure of the motor phase U has been detected.	• Check wiring between inverter and motor. • In case of a false tripping, adapt the settings for the motor phase failure detection.
65291 0xFF0B	Motor phase failure phase V	Phase V failure	No response (Configurable) The error can only be reset after a blocking time (2 sec). Setting parameters: 0x2D45:001	A failure of the motor phase V has been detected.	• Check wiring between inverter and motor. • In case of a false tripping, adapt the settings for the motor phase failure detection.
65292 0xFF0C	Motor phase failure phase W	Phase W failure	No response (Configurable) The error can only be reset after a blocking time (2 sec). Setting parameters: 0x2D45:001	A failure of the motor phase W has been detected.	• Check wiring between inverter and motor. • In case of a false tripping, adapt the settings for the motor phase failure detection.
65305 0xFF19	Motor parameter identification fault	Motor ID fault	Fault	During the automatic identification of the motor, an error has occurred.	• Set motor data so that they comply with the data on the motor nameplate. • Check wiring of the motor.
65334 0xFF36	Brake resistor: overload warning	BrkResistor OL.W	Warning (Configurable) Setting parameters: 0x2550:010	The calculated thermal load of the brake resistor has reached the warning threshold set in 0x2550:008. The regenerative energy is too high.	• Check drive dimensioning. • Check settings for the brake energy management. Note: The warning status is reset if the thermal load falls below the warning threshold of - 20 %.
65335 0xFF37	Automatic start disabled	Auto start disab	Fault	At mains connection, a start command was already available and the automatic start at power-up is set in 0x2838:002 to "Off [0]".	• Deactivate starting command and reset error.
65336 0xFF38	Load loss detected	Load loss	No response (Configurable) Setting parameters: 0x4006:003	In a running motor, the motor load (current) is monitored. When the motor load falls below the threshold value specified in Load loss detection: threshold (0x4006:001) for the period of time specified in Load loss detection: delay time (0x4006:002), load loss protection is triggered.	• Check utilisation
65337 0xFF39	Motor overload	Motor overload	No response (Configurable) Setting parameters: 0x4007:00	If the apparent motor current exceeds a defined threshold value 0x4007:002 for a certain amount of time 0x4007:001, heavy duty monitoring is triggered.	• Check the motor load

LENZE DRIVE FAULTS (CONTINUED)

Code	Fault	Keypad display	Error type/ Response	Cause	Remedy
65366 0xFF56	Maximum motor frequency reached	Max. motor freq.	Warning	• The maximum motor speed set in 0x6080 is active. • The maximum output frequency of the inverter has been reached.	• Check application.
65393 0xFF71	Wrong password	Wrong password	Warning The blocking time for entering a password is more than 10 seconds. (The blocking time is doubled every time an incorrect password is entered.) No password can be entered as long as the blocking time is active.	A wrong password has been entered several times.	• Wait until the blocking time has elapsed and then enter the correct password.
65394 0xFF72	Warning	Warning	Warning No response from the inverter.The decision on whether the machine will be commissioned or not is made by the Controller.	Inverter is not compatible with the Controller/PLC (brand protection). • The Controller has not written a deactivation password in the parameter yet. • The deactivation password written by the Controller is incorrect.	• Use corresponding (compatible) OEM components.
65395 0xFF73	Fatal Error	Fatal Error	Fault Operation of the inverter is not possible.	Error when reading the data from the control unit.	• Switch inverter off and on again. • If the error occurs again, the manufacturer must be contacted, since the control unit or the device has to be replaced.
65396 0xFF74	Power unit fatal error	PU fatal error	Fault Operation of the inverter is not possible.	Error when reading the data from the power unit.	• Switch inverter off and on again. • If the error occurs again, the manufacturer must be contacted, since the power unit or the device has to be replaced.
65413 0xFF85	Keypad full control active	Keypad full ctrl	Warning Both the activity of controlling and the setpoint selection are carried out via the keypad.	If the "Keypad Full Control" control mode is active.	• Clicking the CTRL keypad key stops the control mode again.

For any other faults, see the Lenze VSD manual.

USER SETTING

Setting Name	User Setting	Setting Name	User Setting
Jacking Pump		**Main Pumps**	
Jacking pump mode		Number of pumps	
Jacking pump nominal voltage		Pump limit	
Jacking pump maximum frequency		Pump nominal voltage	
Jacking pump full load current		Maximum frequency	
Jacking pump turn off enable		Pump full load current	
Installation Type			
Pressure Control Setup		**Level Control Setup**	
Pressure transducer units		Tank level units	
Pressure transducer range		Level transducer range	
Setpoint		Level control operation	
No demand speed		Tank level units	
PID proportional (Kp)		Level transducer range	
PID integral (Ki)		Level control operation	
High pressure protection		Setpoint	
High pressure threshold		Duty start step	
Low pressure protection		Standby start step	
Low pressure threshold		Minimum speed	
Secondary analog input A1 assign		Full speed level	
A1 level transducer units		High level protection	
A1 level transducer range		High level threshold	
A1 low level protection		Low level protection	
A1 low level protection threshold		Low level threshold	
Mains bypass enable		Pump cycle protection	
Well wash enable		Maximum flow protection	
Mains tank fill enable		Secondary analog input A1 assign	
Top up stop level		A0 & A1 level transducer range	
Top up start level		Mains tank fill enable	
Flow input assign		Top up stop level	
Low flow alarm enable		Top up start level	
Flow protection type		Well wash enable	
Low flow threshold		Flow input assign	
Flow sensor litres per hour		Low flow alarm enable	
Flow sensor range		Flow protection type	
		Low flow threshold	
		Flow sensor litres per hour	
		Flow sensor range	

Flow Control Setup		Temperature Control Setup	
Flow units		Temperature units	
Flow sensor litres per pulse		Temperature transducer range	
Flow sensing range		Setpoint	
Setpoint		PID proportional (Kp)	
PID proportional (Kp)		PID integral (Ki)	
PID integral (Ki)		Temperature control operation	
Minimum speed		Minimum speed	
High flow protection		Duty change period	
High low threshold		High temperature protection	
Low flow protection		High temperature threshold	
Low flow threshold		Low temperature alarm	
Maximum flow protection		Low temperature threshold	
A0 level transducer enable		Secondary analog input A1 assign	
A0 level transducer units		A1 level transducer units	
A0 level transducer range		A1 level transducer range	
A0 low level protection		A1 low level protection	
A0 low level protection threshold		A1 low level protection threshold	
A1 pressure transducer enable		High auxiliary temperature alarm	
A1 pressure transducer units		High temperature threshold	
A1 pressure transducer range		Low auxiliary temperature alarm	
High pressure protection		Low temperature threshold	
High pressure protection threshold			
Assign Digital BMS			
C0 output assign		C6 output assign	
C1 output assign		C7 output assign	
C2 output assign		C8 output assign	
C3 output assign		C9 output assign	
C4 output assign		C10 output assign	
C5 output assign			
Assign Analog BMS			
A2 output assign		A3 Output Assign	