

Emerson Commander SK and Pumps



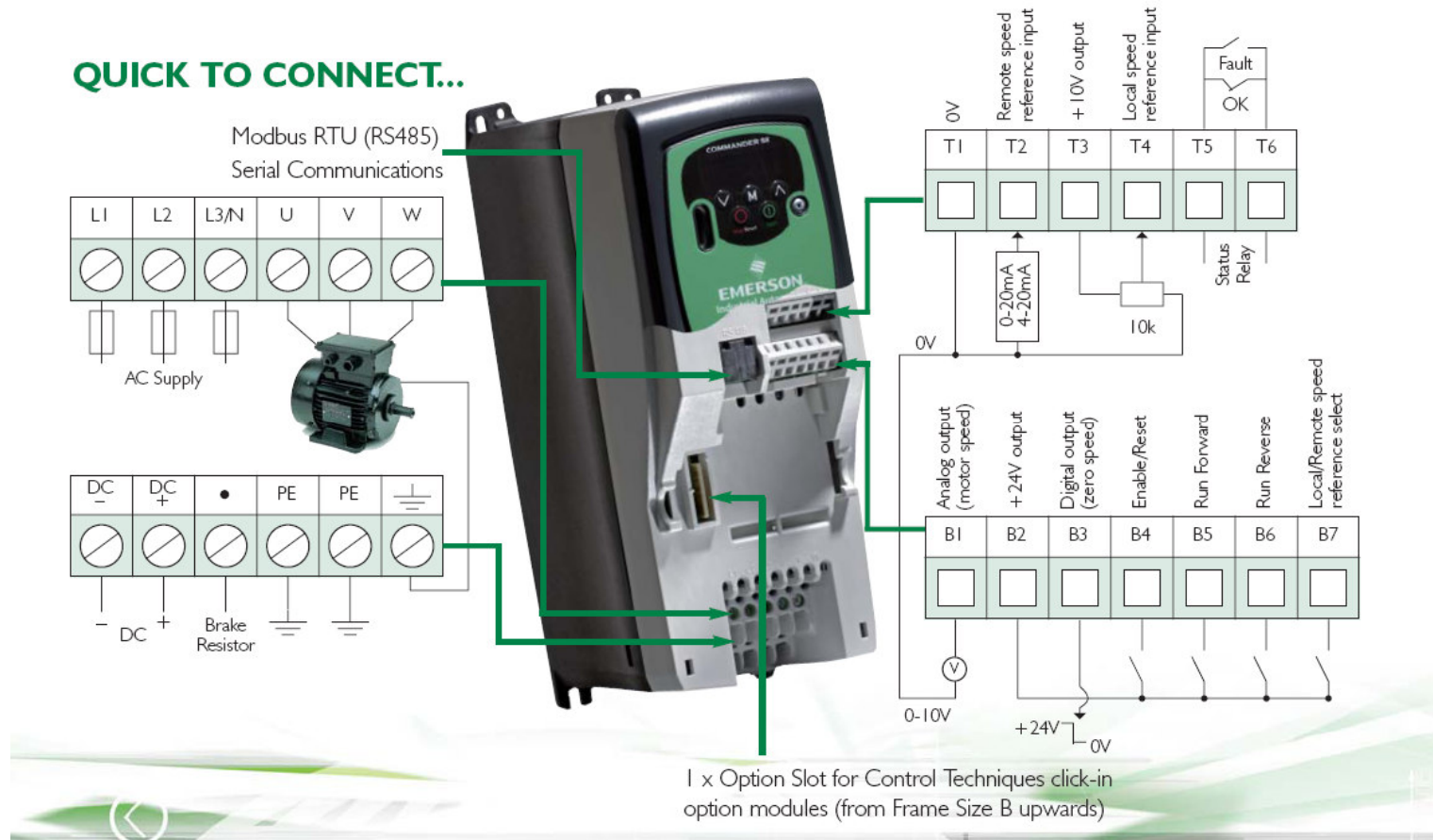
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 - 2.2) VSD's with Pumps
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Commander SK Wiring:

QUICK TO CONNECT...



Commander SK Features:



Commander SK is easy-to-drive and great value. The drive modules are ultra compact and offer excellent motor control. With onboard intelligence, I/O, Ethernet and fieldbus communications options, Commander SK allows you to do much more than you would expect from a general purpose drive. Maximum overload 150% of rated current for 60 seconds

Features:

- Open loop vector control, V/Hz
- Speed or torque control
- Reference input: 0-10V, 0-20 mA, 4-20 mA, 8 Presets, Pulse, PWM (-10 to +10V SM-Bipolar option)
- Digital I/O - All configurable
- 4 inputs, not stop, run, jog, local/remote (default)
- 1 I/O zero speed (default)
- 1 relay drive health (default)
- Switching frequency: 3 kHz (default)
- 230V: 6,12,18 kHz
- 460V: 6,12 kHz
- Output frequency 0 to 1500 Hz
- Accel and Decel ramps (linear and S type)



SK Remote Keypad



**Smart/Logic Stick
(PLC Functionality)**



Commander SK Features:



Features:

- Positive logic control
- Serial communication
- Modbus RTU RS485 via RJ45 connector
- Baud rate 4800, 9600, 19200 or 38400 bits per second
- DC injection braking as standard
- Dynamic braking transistor as standard (except SKA1100025 & SKA1100037)
- Dynamic motor V/Hz for energy saving
- Quadratic motor V/Hz for fan and pump optimization
- Intelligent Thermal Management (ITM) optimizes switching frequency
- Catch a spinning motor
- Power loss ride through
- Automatic no-spin auto-tune for fast performance optimization
- Keypad access to all parameters for more demanding applications



Intelligent Option Modules for I/O and Communications requirements



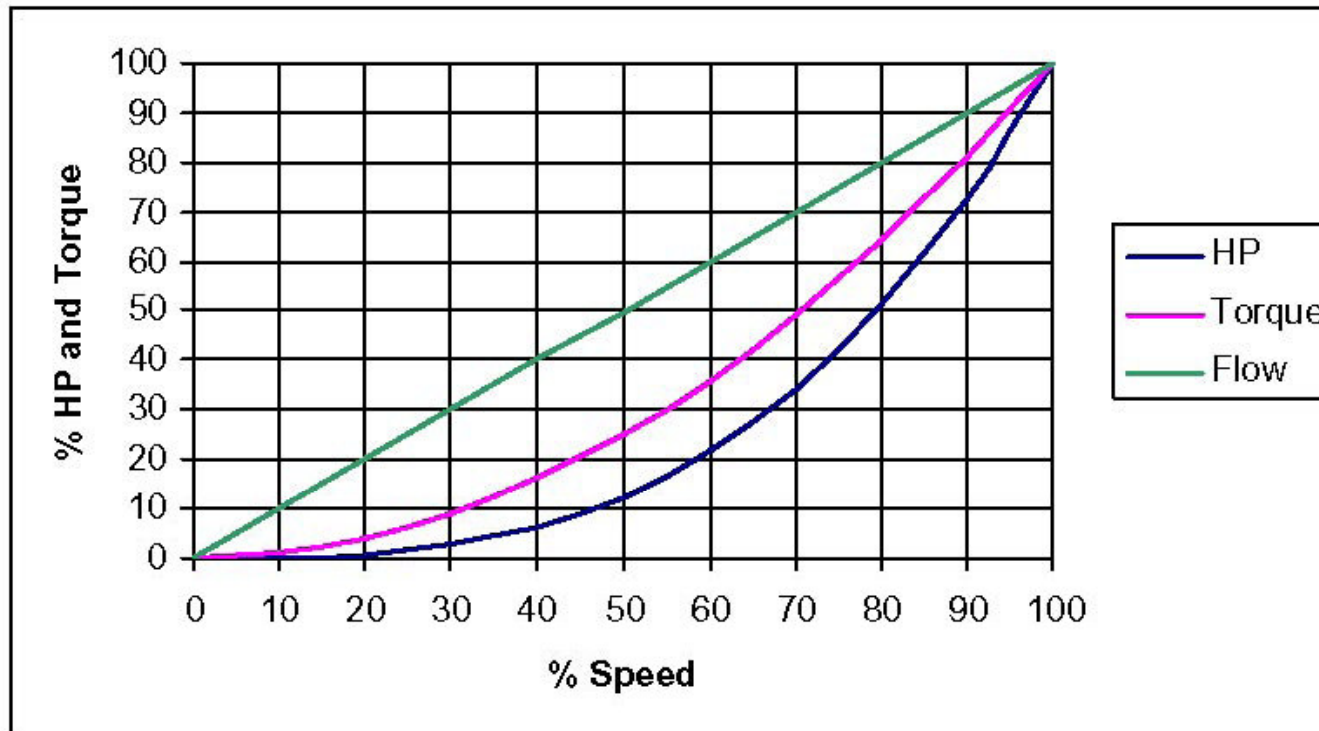
Introduction:

Of all the applications for Variable Speed Control, Centrifugal Pumps with **Variable Torque Load Characteristics** offer the greatest potential for Energy Savings.

Compared with traditional mechanical methods of controlling fans , where throttles are used to regulate the flow while the motor operates continuously at high speed, VSD's control the motor speed and, therefore, the flow. Because the motor typically operates below its maximum speed for the majority of the time, significant energy savings can accrue.



Variable Torque Characteristics:



Notice that at 100% rated speed and a fully loaded pump the horsepower consumption is maximum. If a 20% reduction in speed is allowable by the system process requirements then the pump may be driven at 80% of the maximum motor RPM with a nominal power consumption of 51.2% of the full load.



Variable Torque Characteristics:

Load requires much *lower torque at low speeds than at high speeds*. Horsepower varies approximately as the cube of the speed, and the torque varies as the square of the speed. Examples of Variable Torque Loads are centrifugal fans, pumps and blowers.

Pumps :

Typically sized for maximum flow

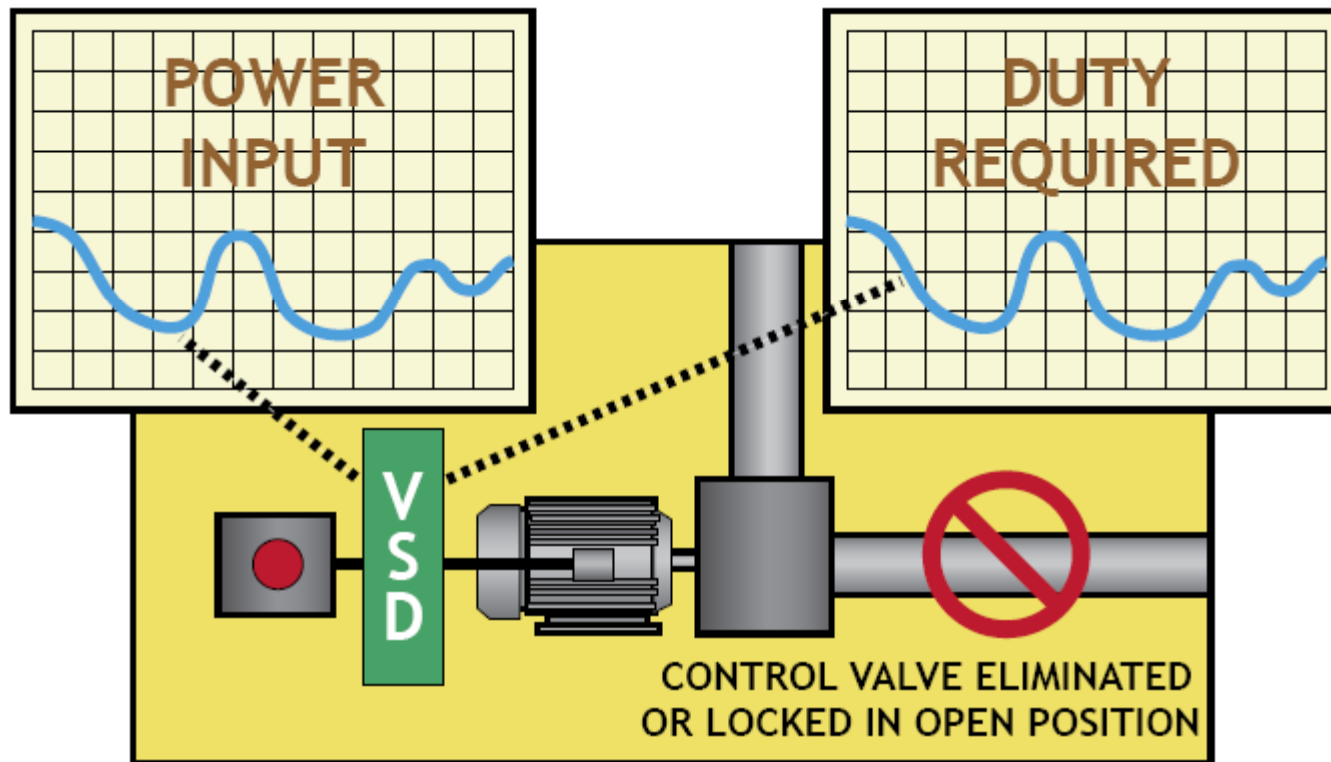
Systems typically operate at less than designed levels

Flow control is normally achieved using an output control valve, output damper or inlet guide valve



VSD's and Pumps :

Now, with a Variable Speed Drive we have tailored the input power to suit the output duty. The throttle or damper is eliminated with savings in maintenance.



VSD's and Pumps:

Affinity law 1 (with impeller diameter held constant) :

Volume Flow is proportional to **speed**

Pressure proportional to the speed **squared**

Power used proportional to the speed **cubed**

Audible noise proportional to fan speed to **5th Power.**

Energy Savings potential is large

$$\frac{Q_1}{Q_2} = \left(\frac{N_1}{N_2}\right)$$

$$\frac{H_1}{H_2} = \left(\frac{N_1}{N_2}\right)^2$$

$$\frac{P_1}{P_2} = \left(\frac{N_1}{N_2}\right)^3$$



VSD's and Pumps:

$$\frac{Q_1}{Q_2} = \left(\frac{N_1}{N_2} \right)$$

Affinity law 1 for FLOW (with impeller diameter held constant) :

Volume Flow is proportional to **speed, double the speed = double the flow.**

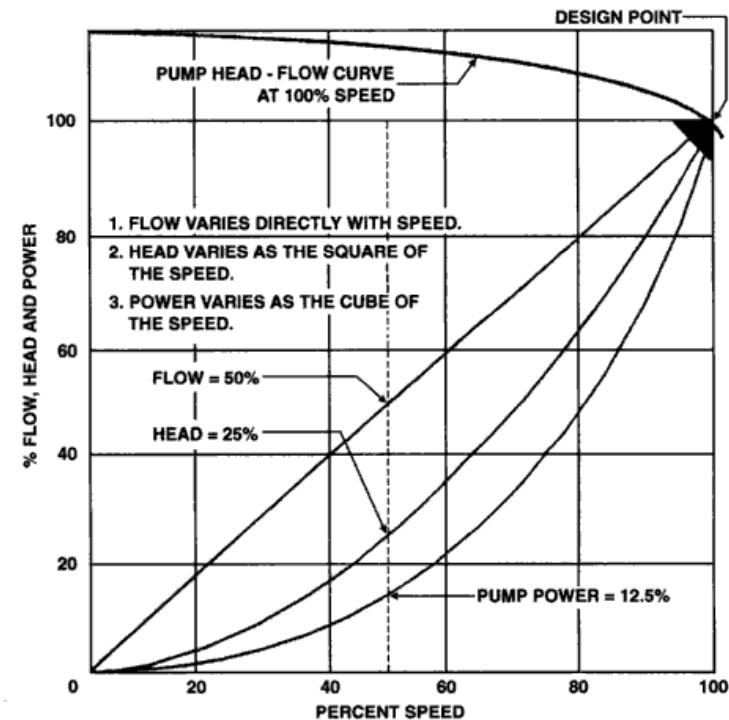
If input speed(N_1) = 1400rpm
(1400rpm Motor with 100m³/h
fan) then at half speed

$$Q_1/Q_2 = N_1/N_2$$

$$Q_2 = (Q_1 \cdot N_2)/N_1$$

$$Q_2 = 100 \cdot 700/1400$$

$$Q_2 = 50 \text{ m}^3/\text{h}$$



VSD's and Pumps:

Affinity law 1 for PRESSURE (with impeller diameter held constant) : $\frac{H_1}{H_2} = \left(\frac{N_1}{N_2}\right)^2$

Pressure proportional to the speed **squared**, **double the speed = multiply the pressure by 4.**

If input speed(N_1) = 1400rpm
(1400rpm Motor with 10 bar
pump at full speed) then at
half speed 700rpm(N_2)

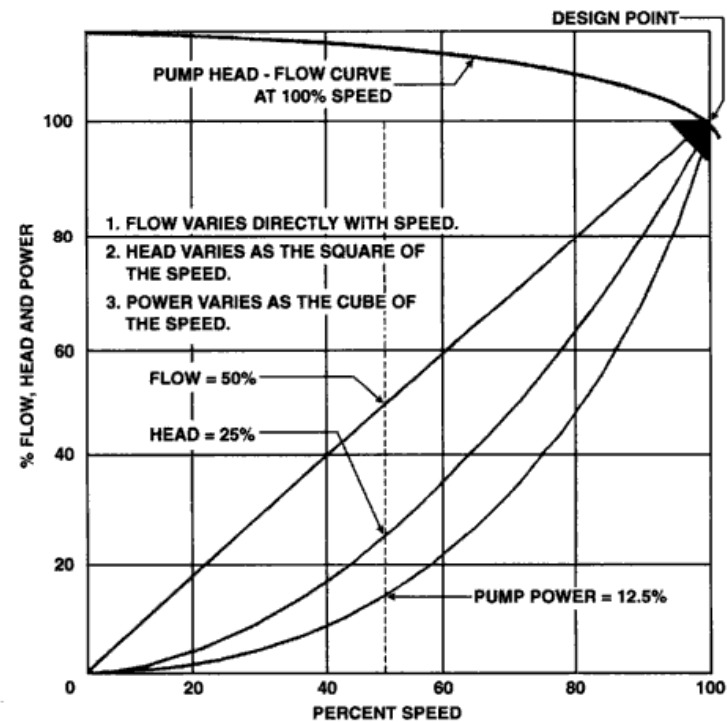
pressure output is

$$H_1/H_2 = (N_1/N_2)^2$$

$$H_2 = H_1/(N_1/N_2)^2$$

$$Q_2 = 10/4$$

$$Q_2 = 2.5 \text{ Bar}$$



VSD's and Pumps:

Affinity law 1 for POWER (with impeller diameter held constant) : $\frac{P_1}{P_2} = \left(\frac{N_1}{N_2}\right)^3$

Power proportional to the speed **cubed, double the speed = multiply the power by 8.**

If input speed(N_1) = 1400rpm
(10kW 1400rpm Motor) then at
half speed 700rpm(N_2)

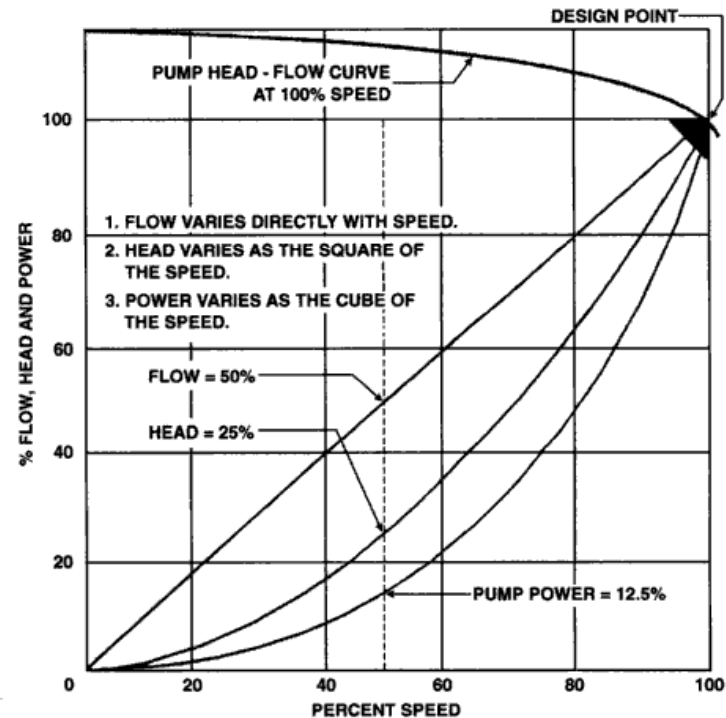
power required is

$$P_1/P_2 = (N_1/N_2)^3$$

$$P_2 = P_1/(N_1/N_2)^3$$

$$P_2 = 10/8$$

$$P_2 = 1.25\text{kW}$$



VSD's and Pumps:

Advantages:

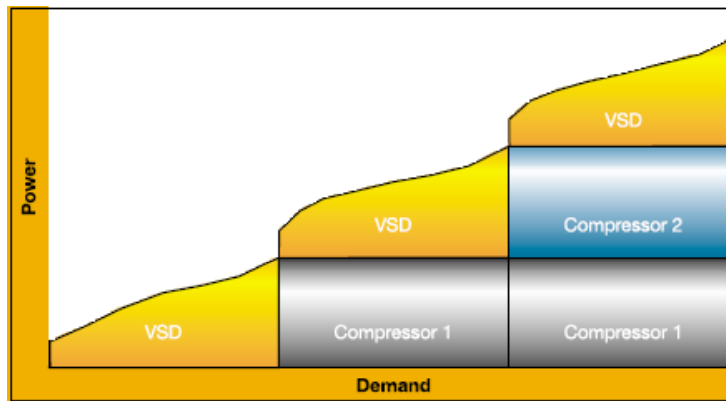
- 1) Audible noise proportional to fan speed
- 2) Energy Savings potential is large
- 3) Cost saving on VSD purchase. Due to low power and torque requirement on start up as seen VSD's can be used on normal duty ratings, ie. Lets say we've got a 22kW Pump and we are going to use the Commander SK series VSD. The SK VSD's frame size 2-6 are rated for normal and heavy duty, the difference between these ratings are that at heavy duty rating the VSD can absorb 175% overload for 40 sec and at normal duty rating it can absorb 110% overload for 215sec. Therefore a 18.5/22kW rated drive can be used, which will deliver 43 A at 110% overload. **The cost difference in list between 22kW and 18.5kW heavy duty VSD's is R 8 340-00.**
- 5) Built-in soft-start - less stress on motor and system.
- 6) Controllable via a BMS, PLC or fieldbus.
- 7) Elimination of expensive valves and valve controls
- 8) Reduces power surges and stress associated with across the line starting
- 9) Provides accurate flow control
- 10) Longer Pump and seal life
- 11) Reduced wear
- 12) Less noise



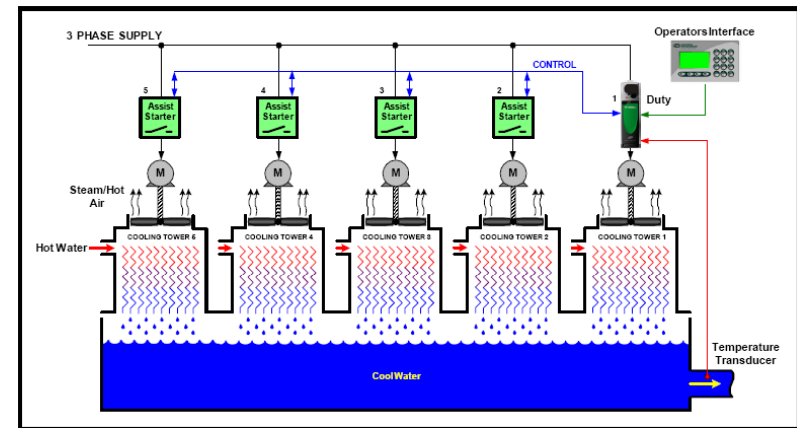
VSD's and Pumps:

In multiple pumps, the test set-up of the control sequencing is critical for optimizing energy efficiency. The most efficient set-up is to bring conventional machines on and off-load to meet the bulk of the demand, with variable speed machine running continuously as a top-up (see fig1).

Fig 1:



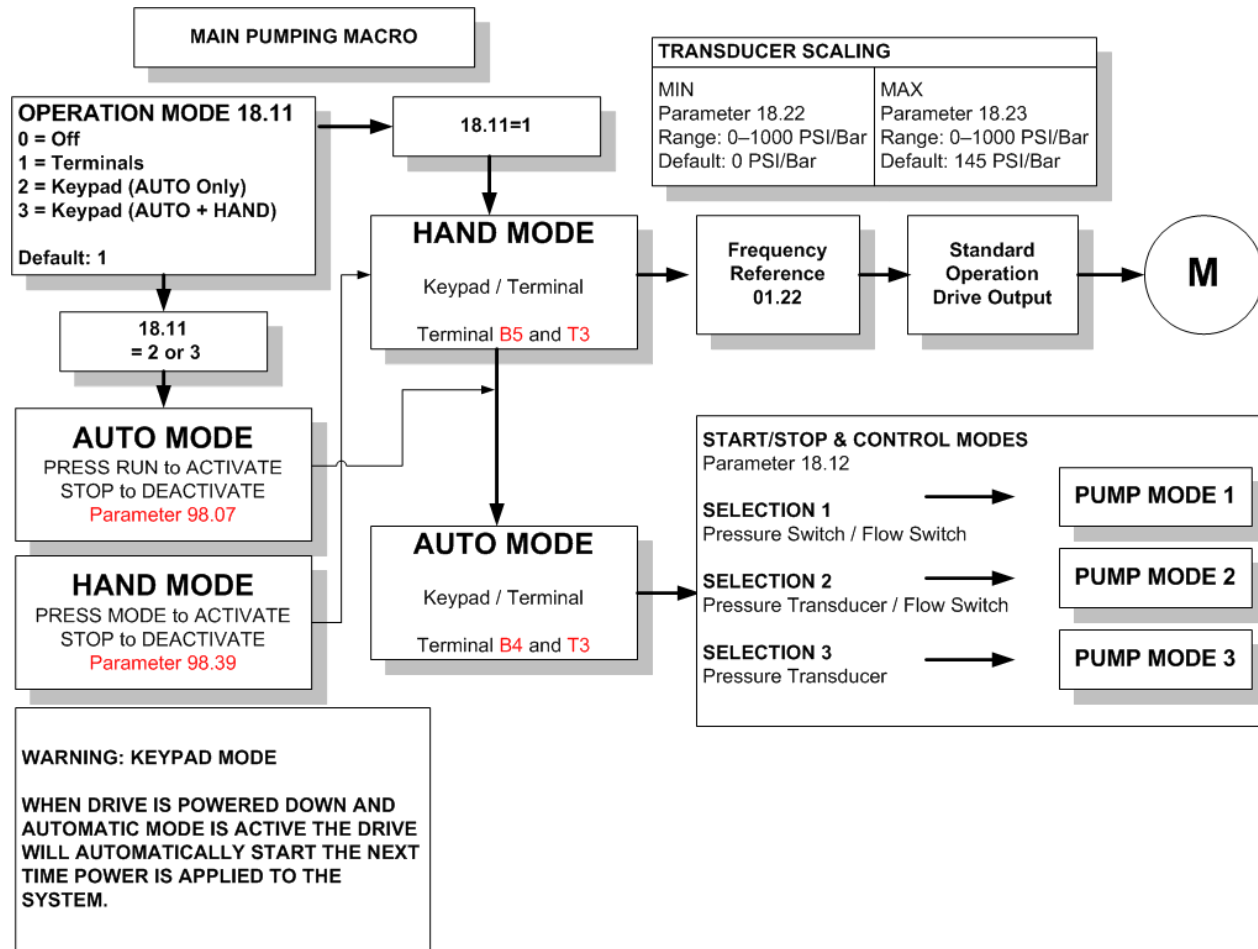
The Duty Assist control is an effective method of controlling multiple pumps or fans in parallel, to maintain the required process demand



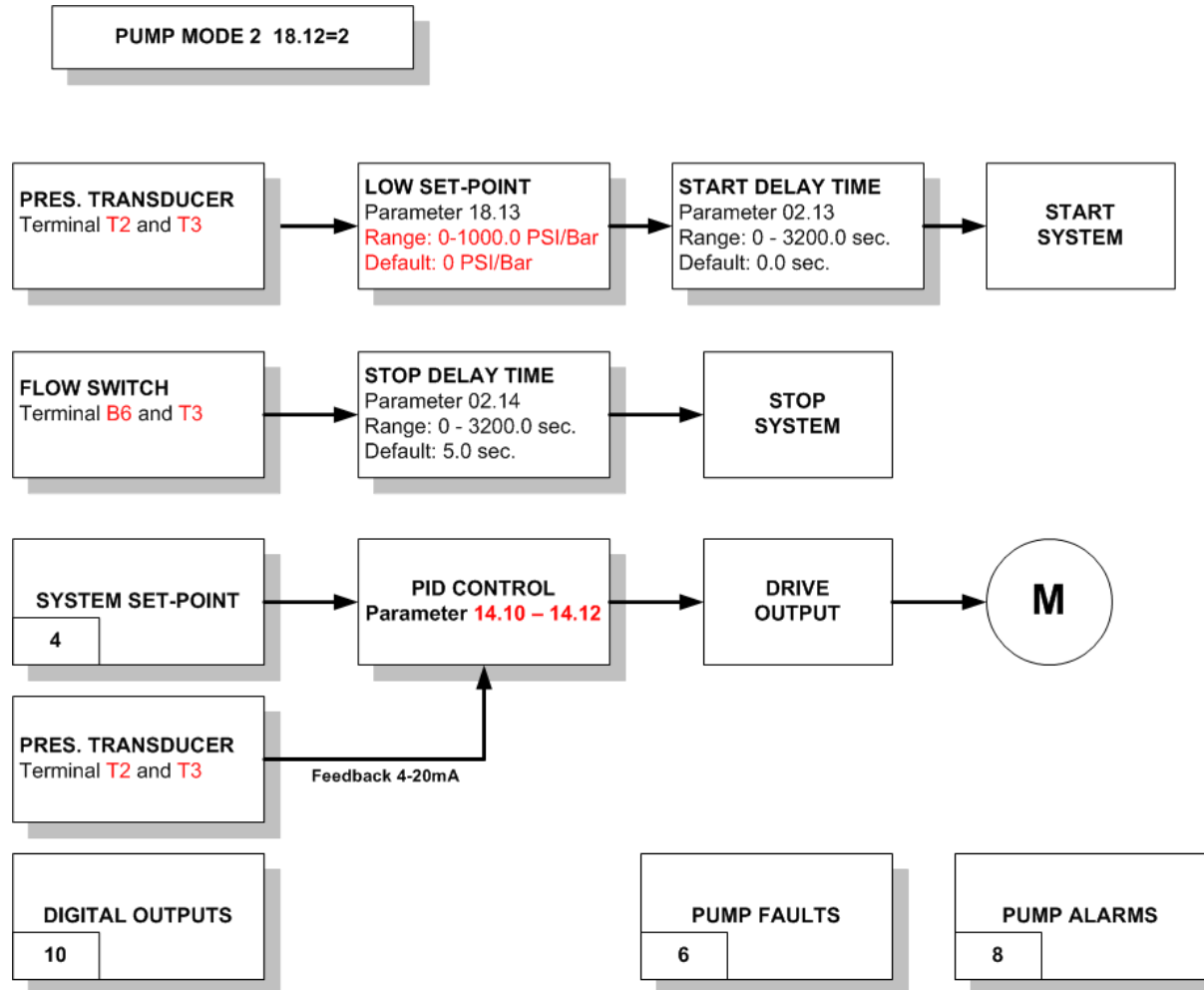
The main propose of using VSD is to enable pumps to work at full load efficiency neglecting the reduction of output capacity. Energy is saved from the increasing of pump working efficiency. Energy usage is reduced by maintaining the required set point: By adjusting the speed of the pump, the pump is no longer cycling on and off (short cycling) eliminating demand load: The overall EER designed values are achieved. In addition to reducing energy use, the system runs smoother and mechanical fatigue and pipe stress is no longer an issue. Slugging is also eliminated.



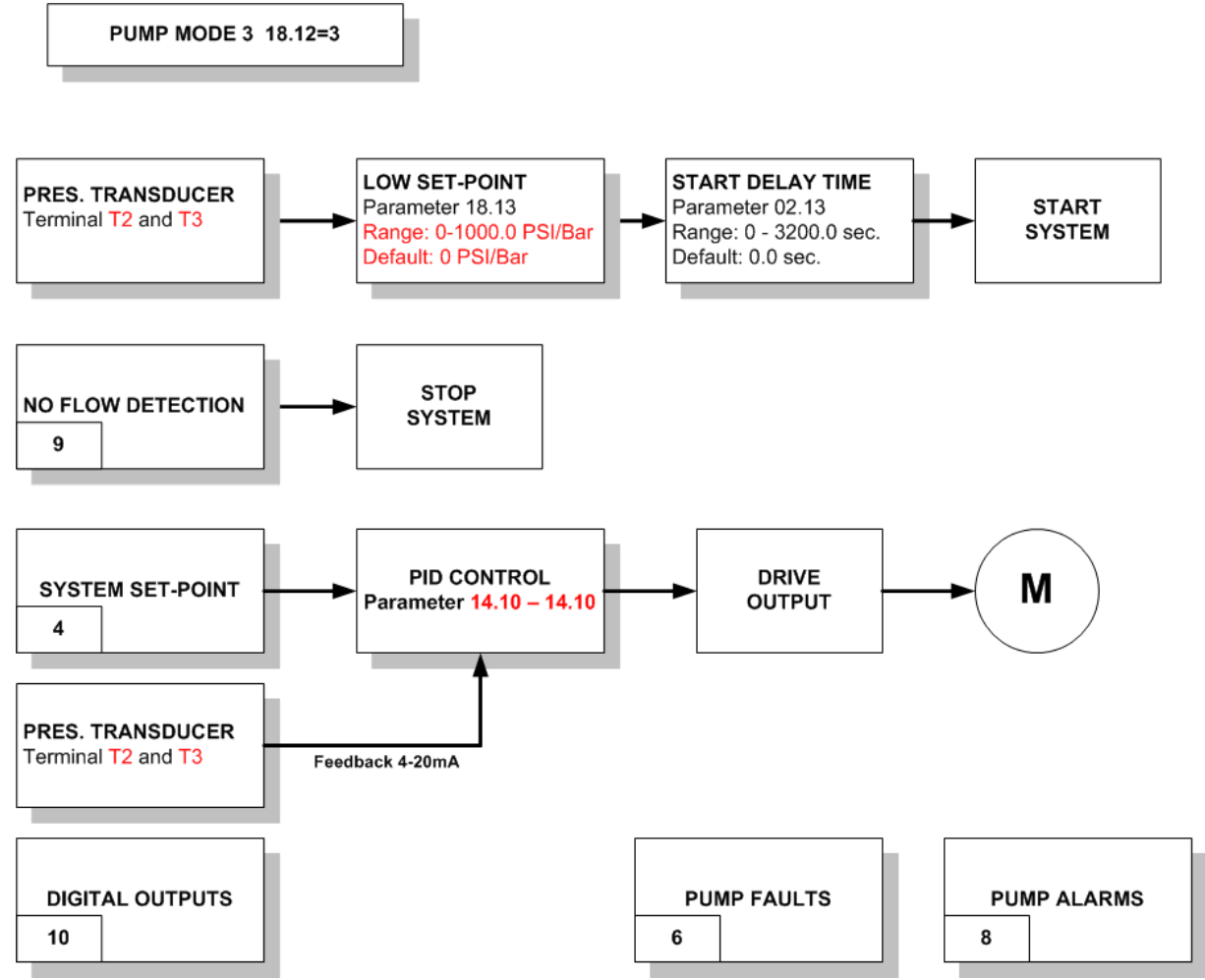
Pump Solution Software



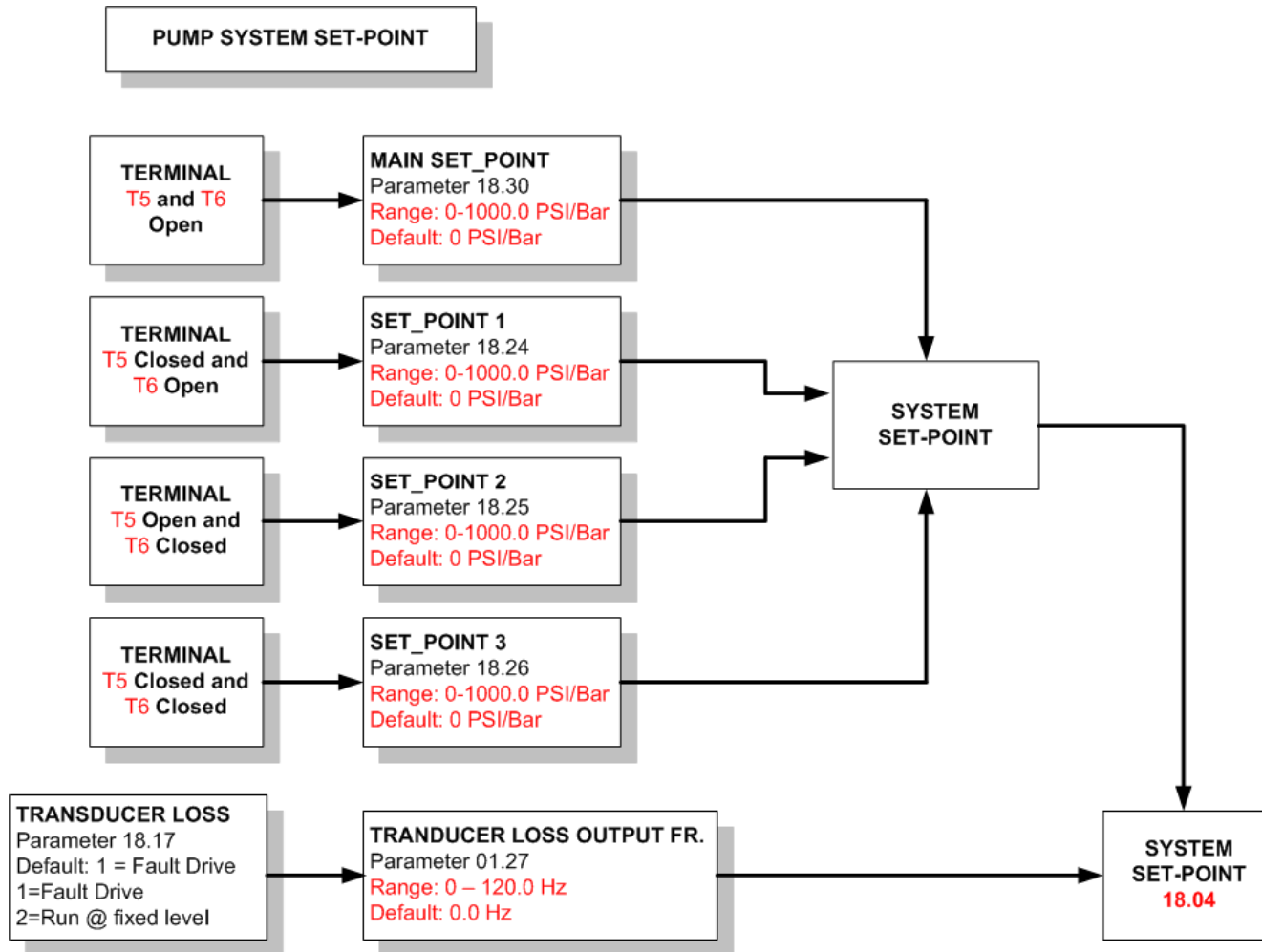
Pump Solution Software



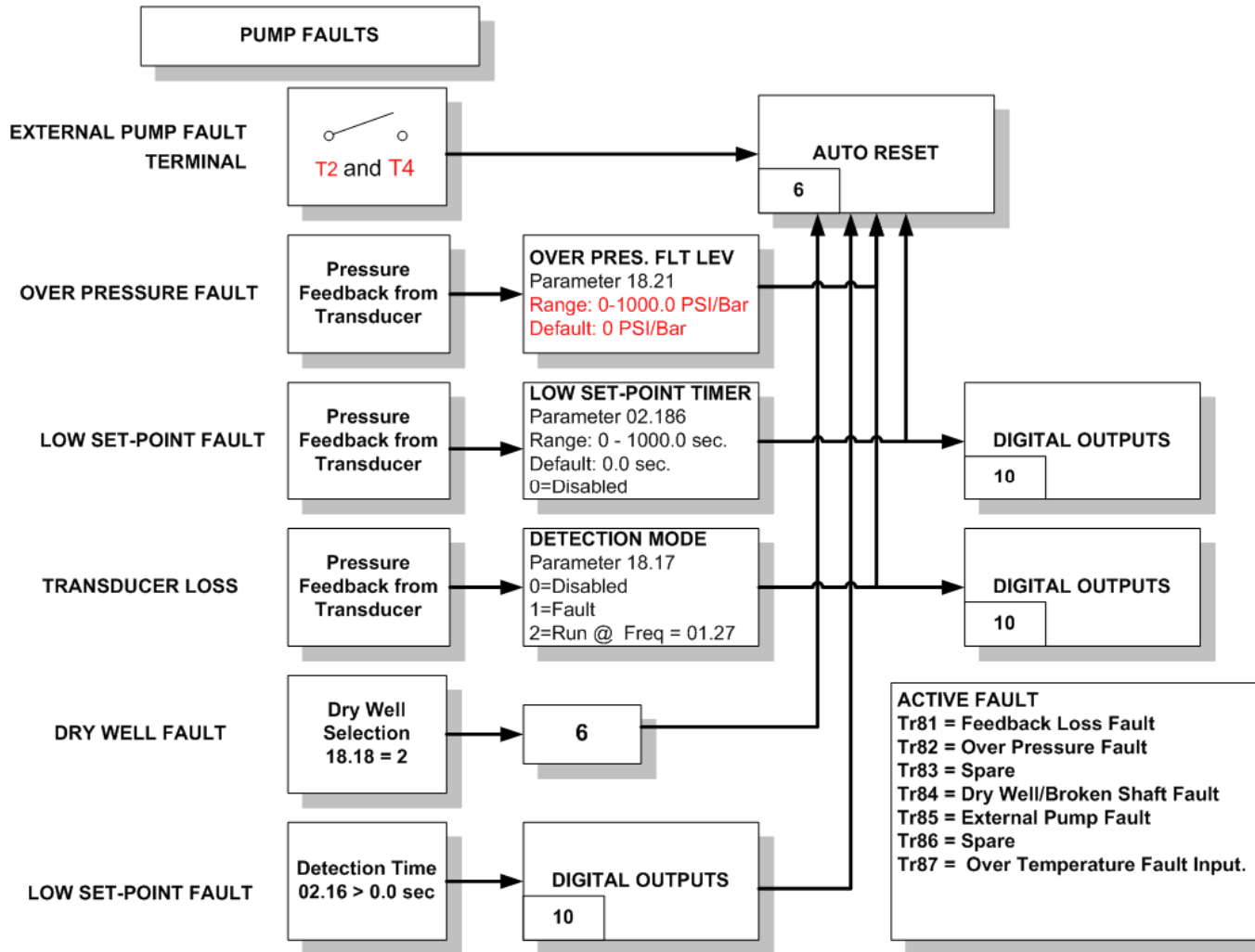
Pump Solution Software



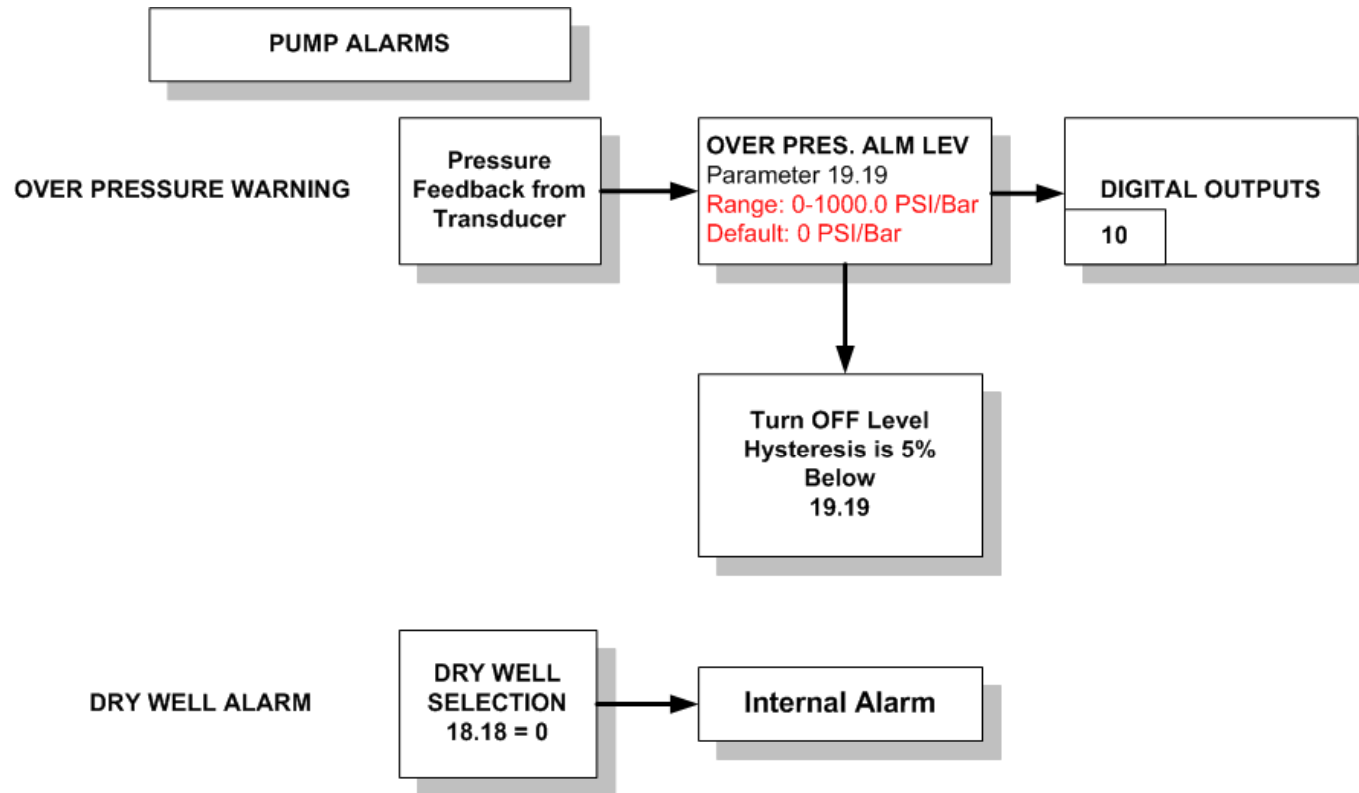
Pump Solution Software



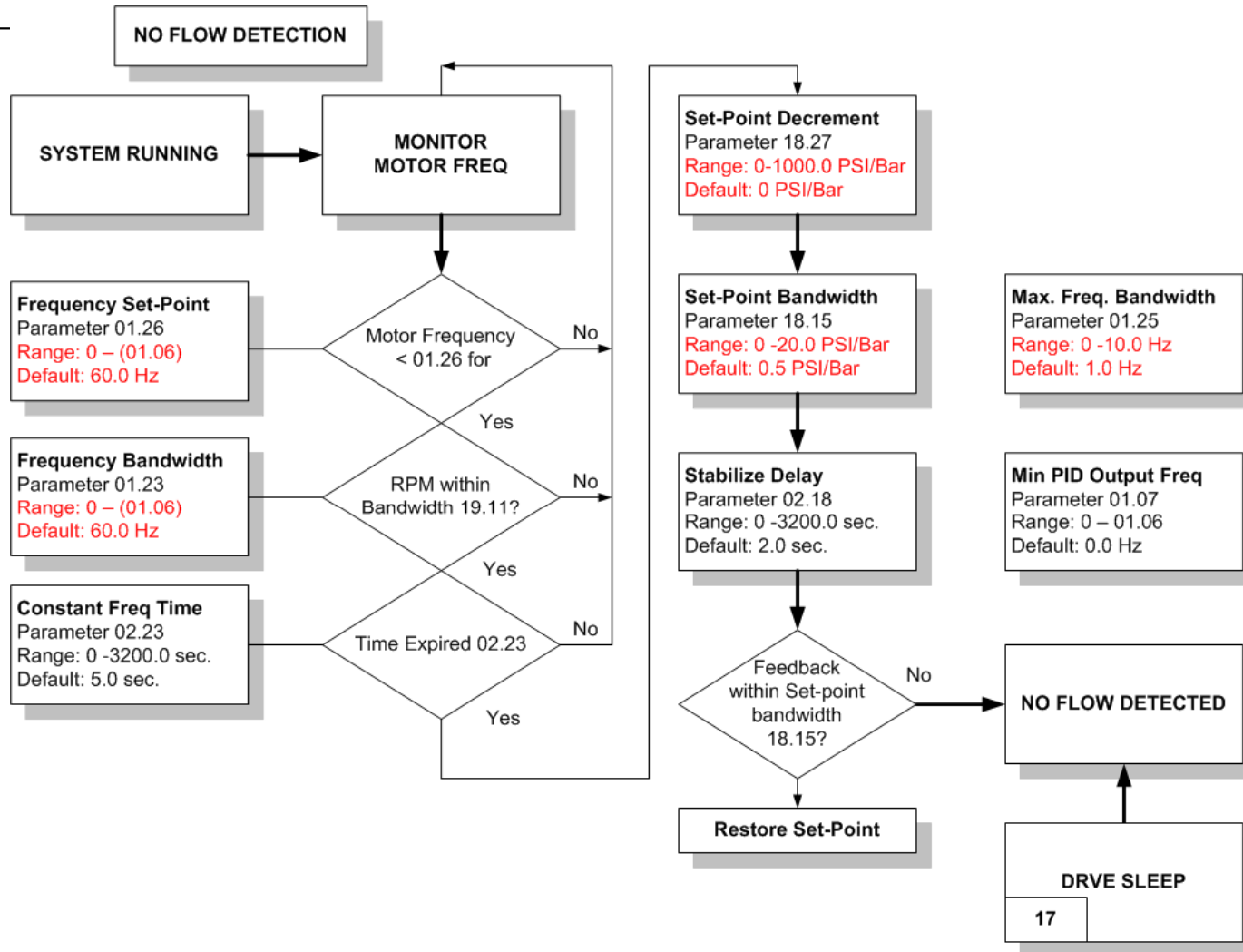
Pump Solution Software



Pump Solution Software

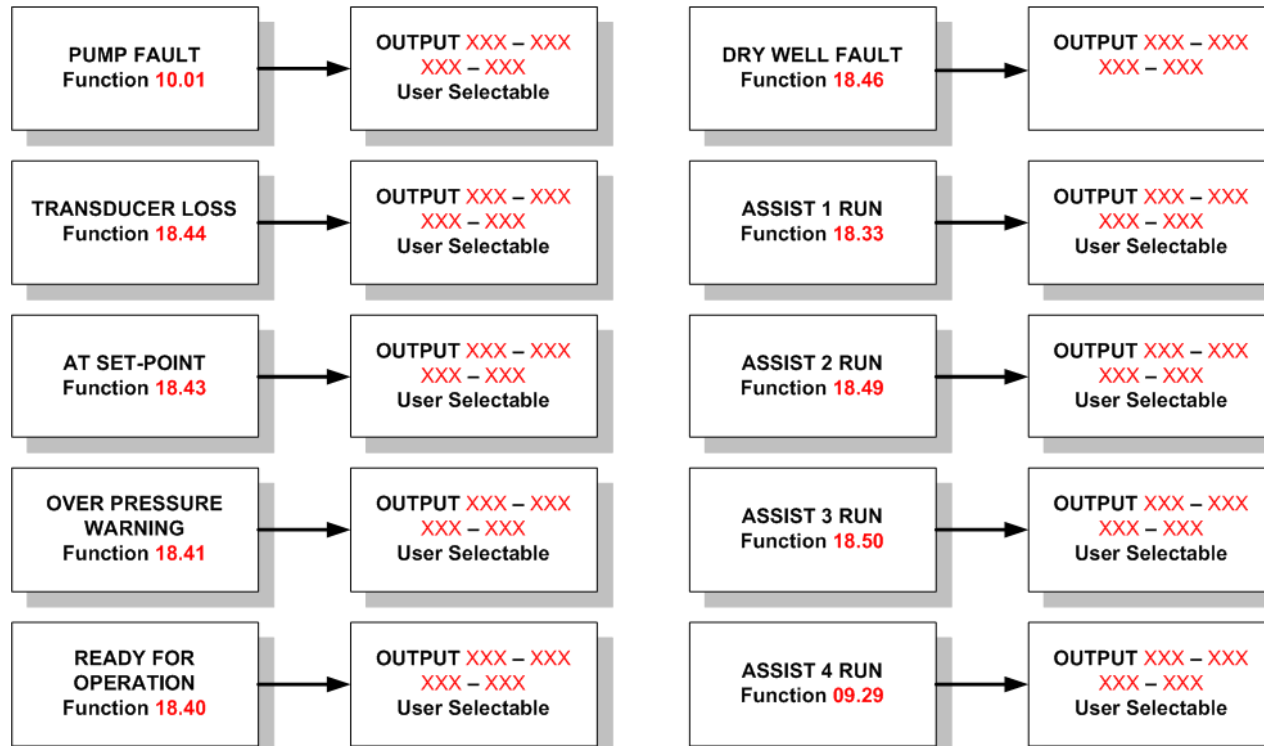


Pump Solution Software



Pump Solution Software

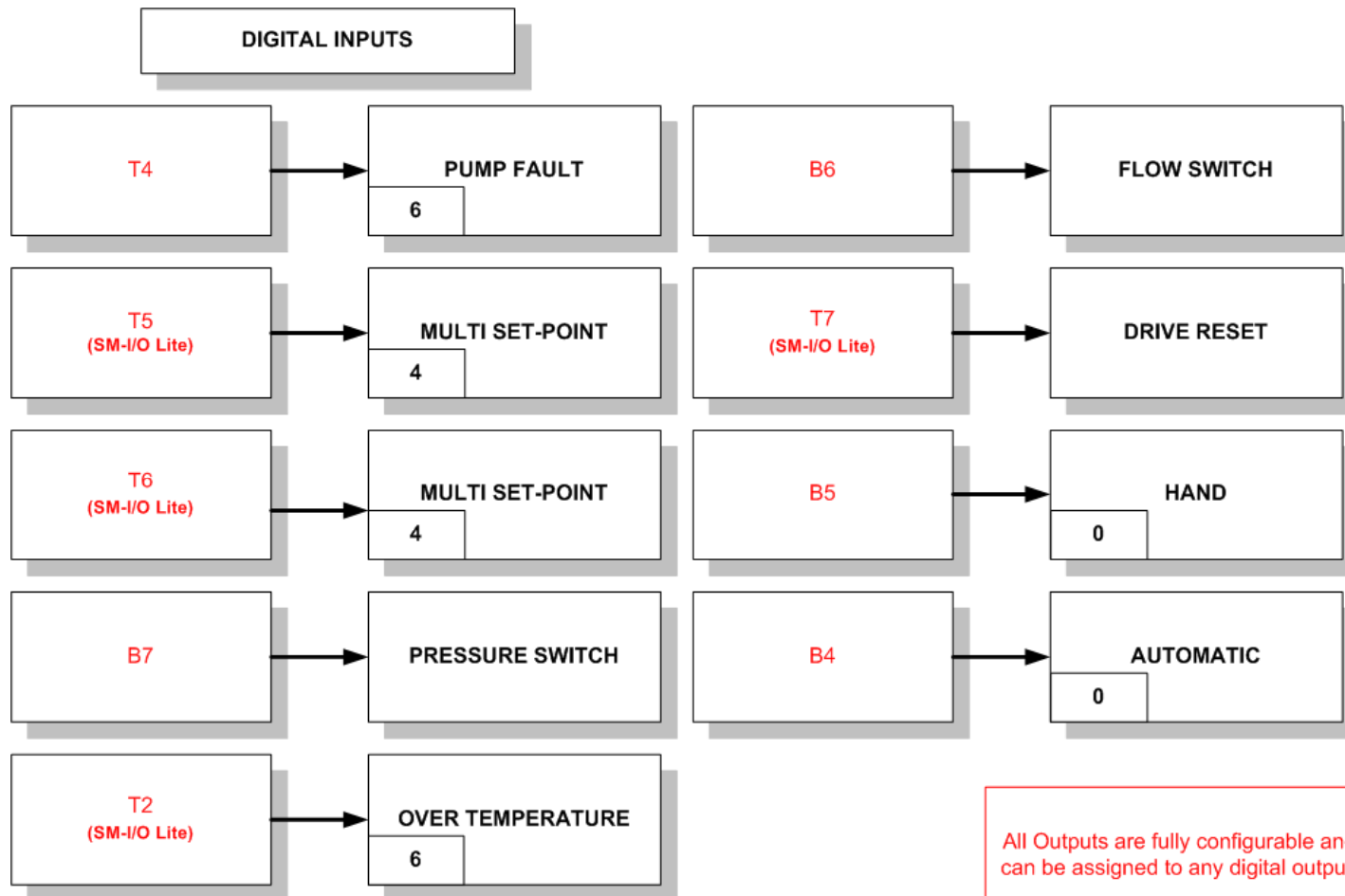
DIGITAL OUTPUTS: FUNCTIONS PARAMETERS XXX- XXX



All Outputs are fully configurable and can be assigned to any digital output.

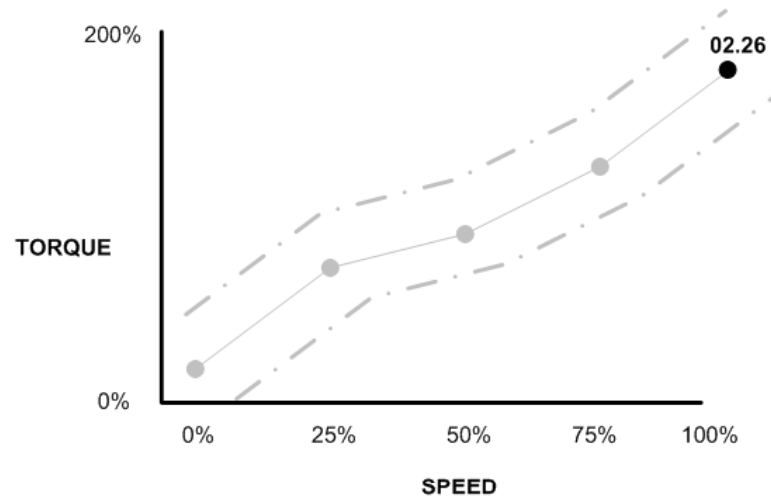


Pump Solution Software

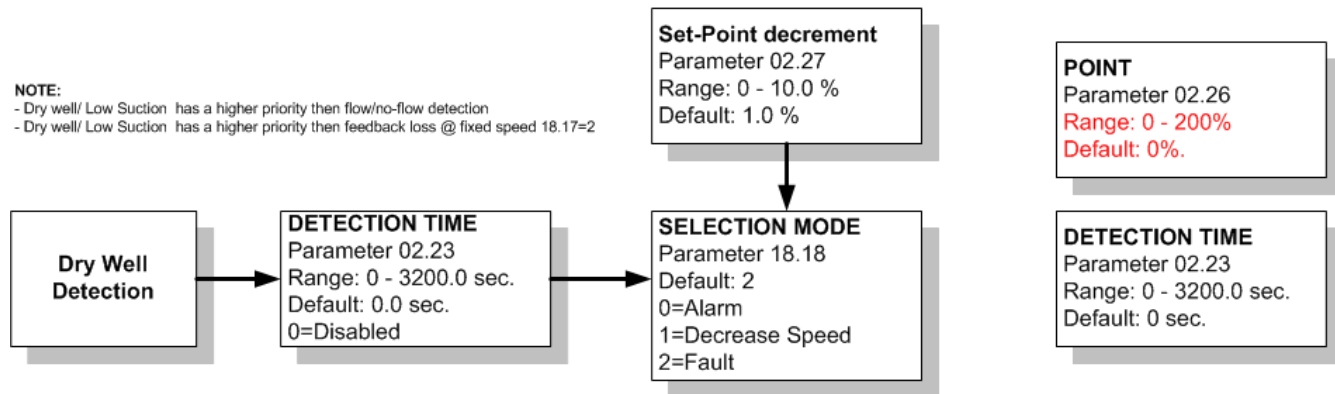


Pump Solution Software

SPEED/TORQUE CURVE, Dry Well/ Low Suction, Cavitation, Broken Shaft

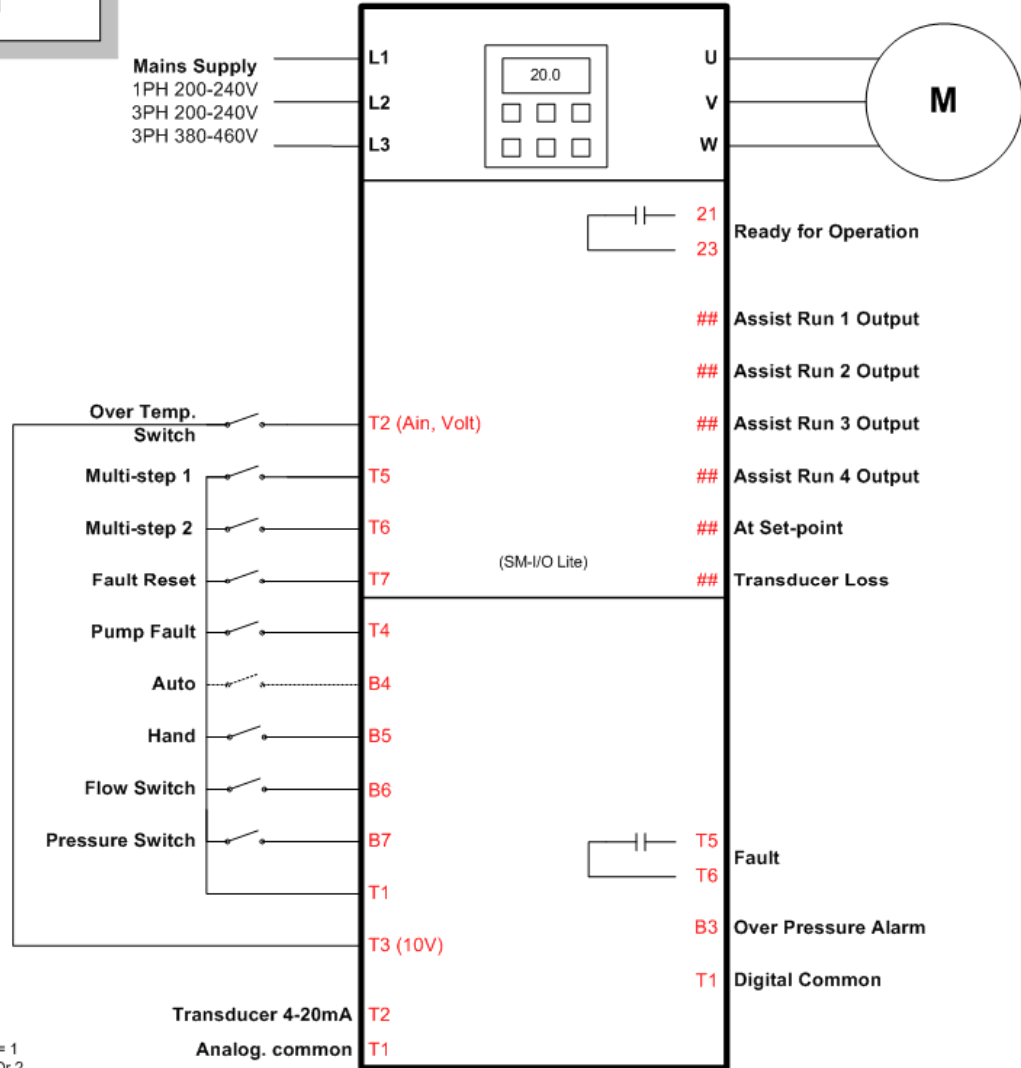


NOTE:
 - Dry well/ Low Suction has a higher priority than flow/no-flow detection
 - Dry well/ Low Suction has a higher priority than feedback loss @ fixed speed 18.17=2



Pump Solution Software

WIRING DIAGRAM



NOTE:
 - Pressure Switch Input B7 Only active in Pump Mode 1 18.12 = 1
 - Flow Switch Input B6 Only active in Pump Mode 1 18.12 = 1 Or 2



Pump Solution Software

SLEEP FUNCTION

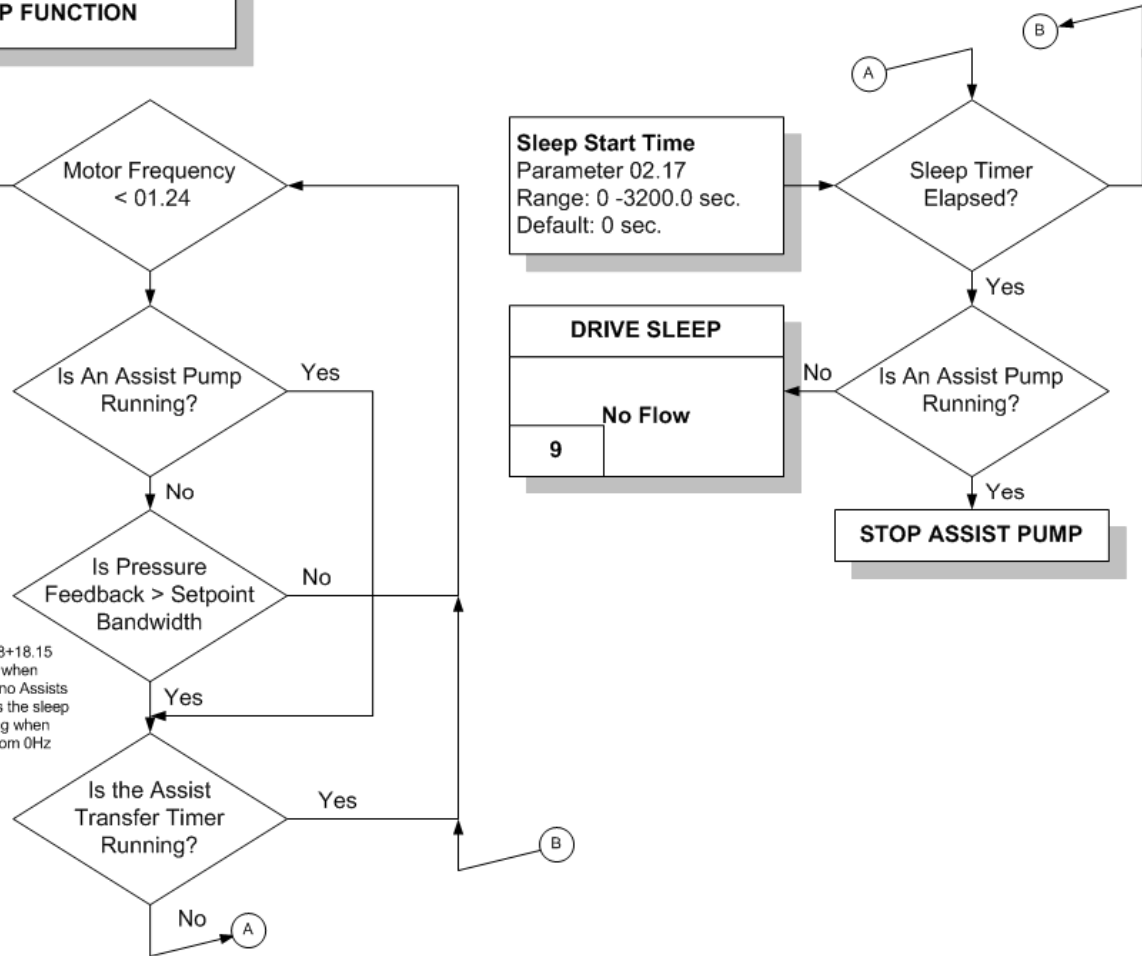
Minimum Sleep Freq
 Parameter 01.24
 Range: 0 - 7200 RPM
 Default: 0 RPM
 0=Disabled

Sleep Start Time
 Parameter 02.17
 Range: 0 - 3200.0 sec.
 Default: 0 sec.

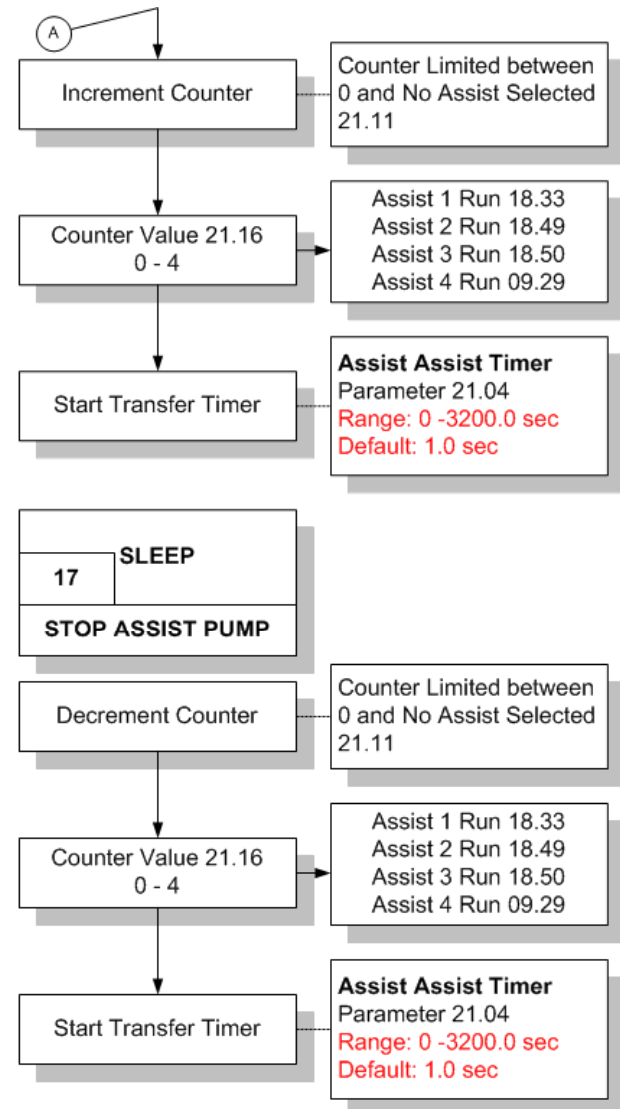
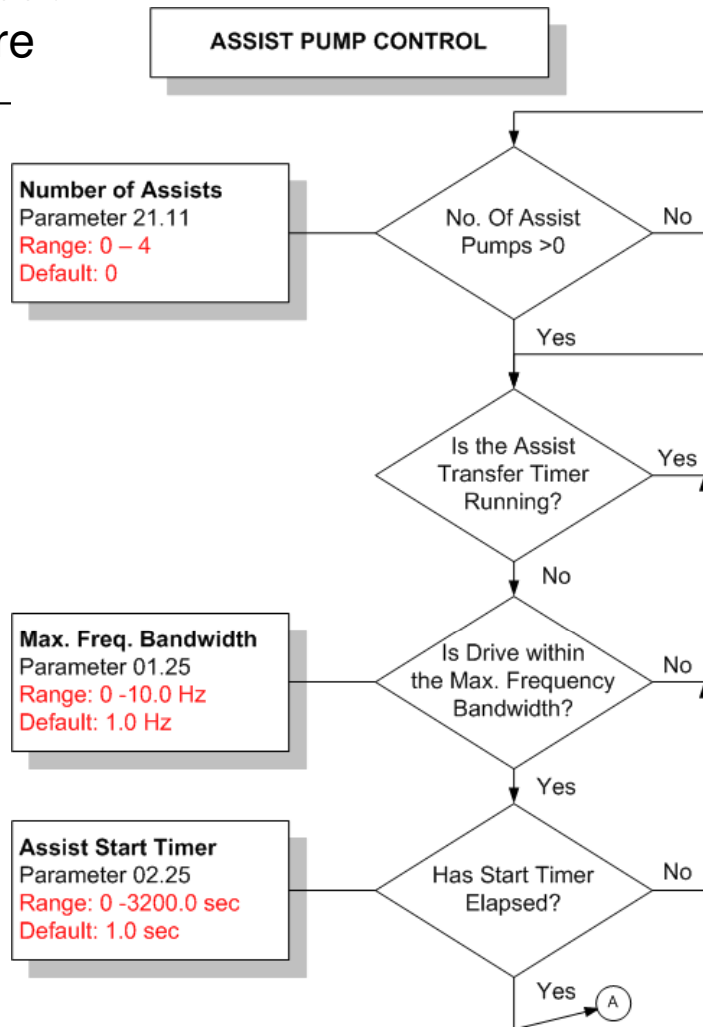
DRIVE SLEEP

No Flow
9

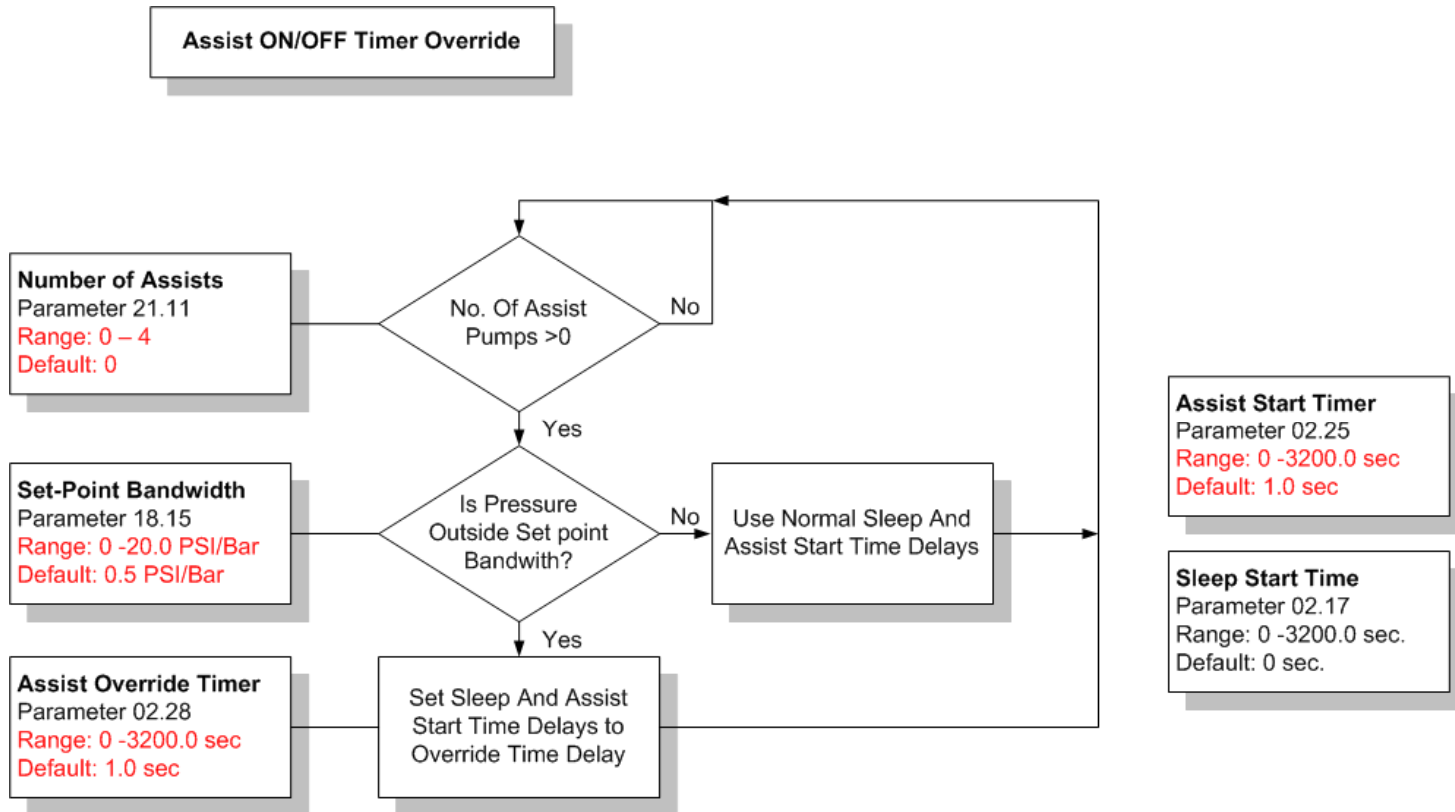
18.02 > 18.08+18.15
 Only Used when
 Operating with no Assists
 running. It stops the sleep
 timer elapsing when
 initially run from 0Hz



Pump Solution Software



Pump Solution Software



Support and Service:



SK Technologies being part of a authorized distributor network across the country, can offer support in all major cities. All distributors have stock on hand as well dedicated service teams to support the products. Control Techniques have a Drive Center in Johannesburg which handles all of the repairs, special system design and distributors.





Thank You !

For more information please contact us on info@sktechnologies.co.za
Or visit the SK Technologies website at:

www.sktechnologies.co.za

