ImPulse CL

Variable Speed Milk Pump Controller
Single Float *Continuous Level* System
Installation & Operation Manual

STOP

READ FIRST

BEFORE installing ImPulse or calling Customer Service for assistance, please read this Manual in full. We have very few questions, problems or complaints when Manual is read and followed. Thank you.

ImPulse CL

Table of Contents

INSPECTION & STORAGE

The ImPulse CL System consists of:

- The ImPulse CL Controller in an enclosure
- A liquid level float assembly (stainless float on a stainless steel probe)

Inspect the ImPulse for shipping damage. If any damage is found, report it to the carrier immediately. Check inside the controller for any visual damage**. Do not attempt to operate the ImPulse if obvious damage exists.**

Storage should be in a clean, dry location. Do not store in an area where the ambient temperature exceeds 149ºF or goes below -4ºF. Do not store in areas of high condensation or corrosive atmosphere.

IMPULSE CONTROLS

Probe Assembly

The probe assembly requires a 1.5" diameter hole in the receiver or receiver lid.

Probe Assembly Length

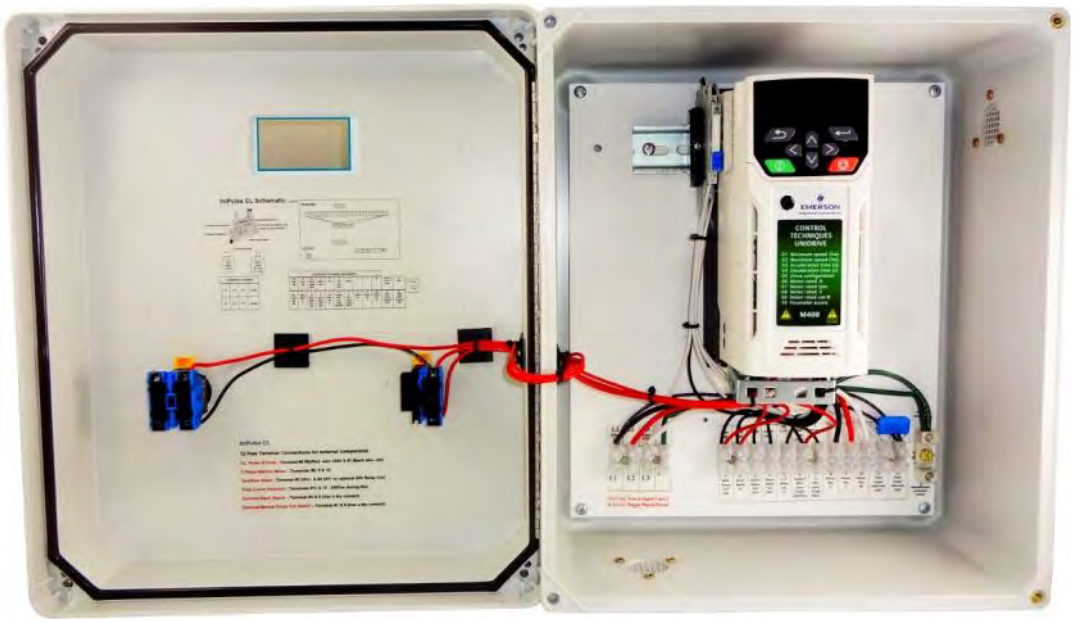
There are four different length probe assemblies to accommodate the different sizes of receiver vessels. Select the proper probe length from the chart below:

Receiver Size	Probe Length
18" x 18"	24"
18" x 24"	24"
26" x 30"	30"
44” x 30”	40”
60" x 30"	60"

IMPULSE CL GENERAL SPECIFICATIONS

The output voltage cannot exceed the mains input voltage.

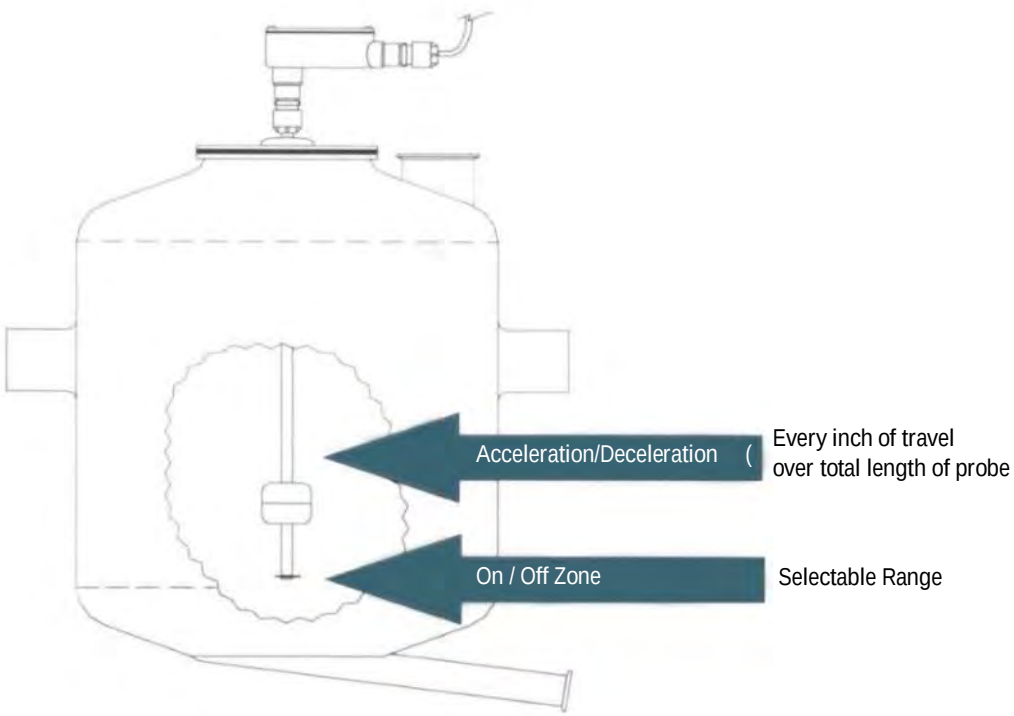
Output Frequency:	0.2 to 120 Hz
Controls:	Fully programmable settings for all parameters
Environment:	Enclosure resistant to low pressure spray from front and sides.
Ambient Temperature:	14ºF to 122ºF
Humidity:	20% to 95% non-condensing
Fault Protection:	· Over current · Under Voltage · Drive Over Heat · Over Voltage



IMPULSE CONCEPT

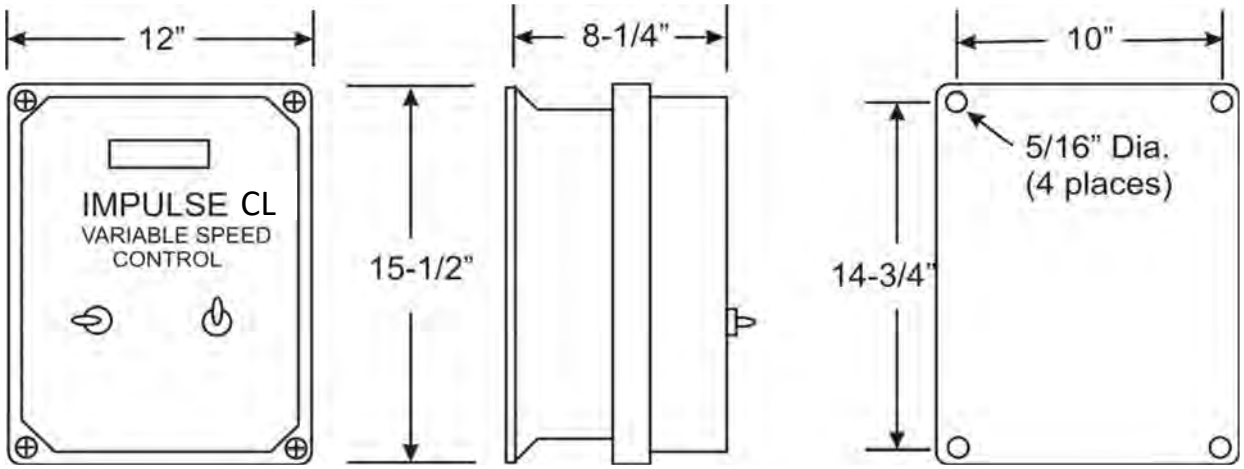
The ImPulse Controller varies the milk pump speed in order to pump the milk through a plate cooler as slowly as possible while still keeping up with milk inflow in the receiver. Usually the pumping rate is significantly less than the maximum, so the cooling efficiency of the plate cooler is increased, resulting in reduced electrical needs for refrigeration. The operational concept of the ImPulse is explained below. This will assist in setting up and troubleshooting a system.

ImPulse uses a float to indicate the milk level in the receiver.



IMPULSE CL MECHANICAL INSTALLATION

The ImPulse CL controller is enclosed in a fiberglass enclosure. Both the single and three phase units are the same physical size.



PHYSICAL DIMENSION

- Mounting holes are 5/16" diameter for 1/4" fasteners.
- Allow 6" above, below and in front of the ImPulse CL controller for cooling air circulation.
- Cable access may be from the sides, top or bottom of the ImPulse enclosure. Cables required are main power in, power out to the motor and cabling to liquid level probe assembly.
- Do not allow any conductive material to enter the ImPulse enclosure or damage may result.
- The ImPulse CL controller should be located in a vibration free environment.
- The operating temperature range is 32º F to 104º F. Do not mount the ImPulse CL controller in direct sunlight on hot surfaces or near heat producing equipment.
- Mount ImPulse CL controller vertically which allows natural convection to aid In cooling the heatsink fins on the back of the drive unit.
- The ImPulse CL controller has a viewing window in the front cover. This shows the status and output of the controller.
- Power should be left on continuously to the ImPulse CL controller unless performing service. This will aid in keeping the electronics dry.

LOCATION

If the dairy has a cow ID system, the ImPulse CL controller should be mounted as close as possible to the milk pump in order to minimize radio frequency interference. Special attention should be give to routing of the shielded power cable to the ImPulse CL controller to the milk pump motor, keeping the cable as far as possible away from the ID system antennas and communication wiring.

The ImPulse CL controller is designed to withstand low pressure washing while providing adequate ventilation for cooling. This should be taken into consideration when locating the controller.

CONNECTING IMPULSE CL TO A WASHER PANEL AND PLATE COOLER

System Washing

The ImPulse CL can be connected to an Automatic Pipeline Washer to kick into the Wash Mode automatically when the system is high speed washing. You will need a relay with a coil voltage that matches the wash panel's signal voltage to activate the high speed wash mode. You also should use 18/2 cable to connect to the relay and the ImPulse CL controller. Connect the 18/2 cable to the 10 pole barrier strip - terminals 2 and 6. Connect to the relay so that when in the wash mode these 2 wires are contacted together to activate the wash mode of the ImPulse CL Controller probe and float. This is shown in the Wiring Diagram on Page 11 of this manual.

Available relays

12V AC/DC rated coil with 6 amp SPDT contacts - P/N - P29750NP

24V AC/DC rated coil with 6 amp SPDT contacts - P/N - P29751NP

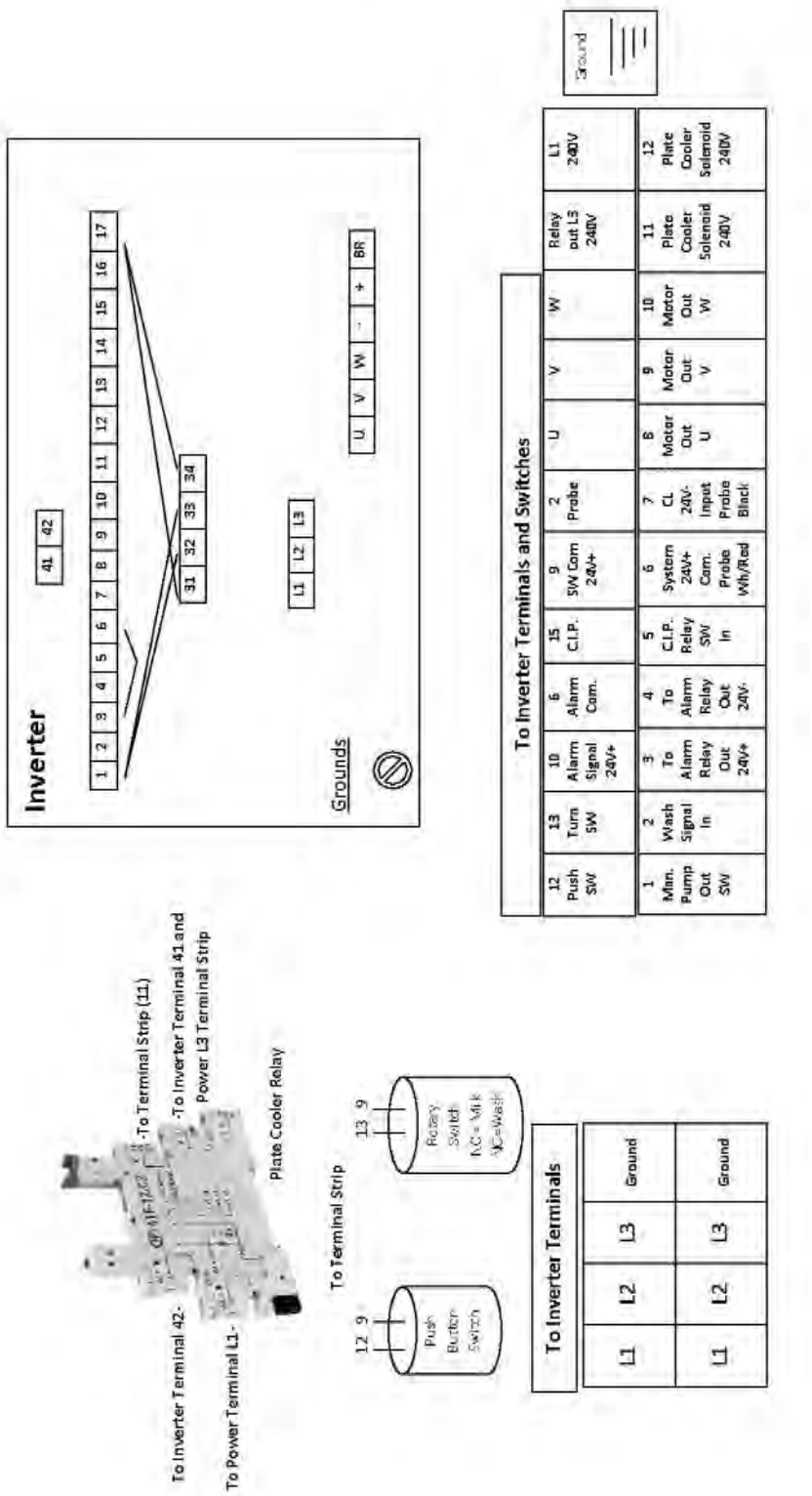
120V AC/DC rated coil with 6 amp SPDT contacts - P/N - P29752NP

220V AC/DC rated coil with 6 amp SPDT contacts - P/N - P29753NP

Plate Cooler Water

If you want to save on water going through the Plate Cooler, install a water solenoid valve that the ImPulse CL will control. The ImPulse CL has a relay contact programmed to activate only when the milk pump is running. The ImPulse CL relay is rated for up to 6 amps 240V AC. If you have a washer panel, you can install a relay to automatically turn the plate cooler water on and off when in **milk mode**. You want to have the plate cooler water off during the **wash mode**. Connect a 230V water solenoid to terminals 11 & 12 on the 12-pole terminal in the ImPulse CL Controller. This is shown on the Wiring Diagram on Page 11 of this manual.

IMPULSE CL SCHEMATIC



IMPULSE CL SYSTEM EMERSON M400 INVERTER CONNECTIONS

Probe: Red+ to Terminal #9 and Black- to Terminal #2 for the 24vdc.

Manual Pump Out Switch: To Terminal #9 and Terminal #12.

Milk/Wash Switch: To Terminal #9 and Terminal #13.

C.I.P. Relay N.O.: To Terminal #9 and Terminal #15.

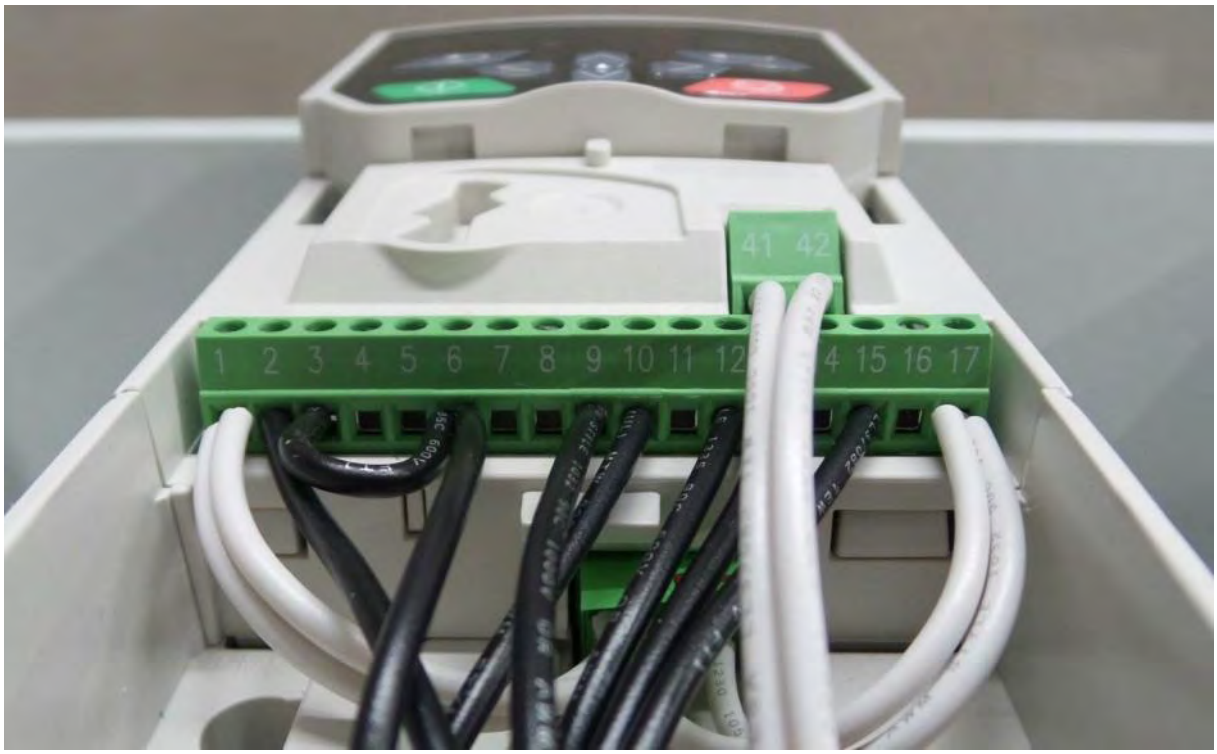
Alarm N.O.: To Terminal #6 = +24vdc and Terminal #10 = -24vdc switched.

Plate Cooler Relay Power N.O.: Terminals #41 and #42 = activated when in Run.

1 Black Jumper wire: Install on Terminals #3 and #6.

4 White Jumper wires: Two from #17 Main Control Terminal to Safe Torque Terminals #31 and #34. Two more from #1 Main Control Terminal to Safe Torque Terminals #32 and #33.

NOTE: The main display will show "Ready" with the above white jumpers installed; however, it will display "Inhibit" if not installed.



WIRE & CIRCUIT BREAKER SIZING

Input

Model	Motor H.P.	Power Wire Size	Motor Wire Size	Circuit Breaker
230 VAC 1 Phase	2 H.P.	16 ga	16 ga shielded	20 Amp
230 VAC 3 Phase	2 H.P.	16 ga	16 ga shielded	16 Amp
480 VAC 3 Phase	2 H.P.	16 ga	16 ga shielded	10 Amp
230 VAC 3 Phase	3 H.P.	12 ga	16 ga shielded	20 Amp
440 VAC 3 Phase	3 H.P.	12 ga	16 ga shielded	16 Amp
440 VAC 3 Phase	5 H.P.	12 ga	16 ga shielded	16 Amp

NOTES

Use shielded cable from the ImPulse CL to the motor. Connect the shield at both ends to earth ground for RFI suppression reasons.

WIRING

It will be necessary to drill holes in the enclosure for the input power, output to the milk pump motor and the cable to the liquid level float assembly. All holes must be fitted with water tight fittings.

1) Wire the Milk Pump motor to motor terminals (MU, MV, MW) on the terminal block using 16 ga shielded cable. Only three phase motors can be used. Make sure the cable from the ImPulse to the motor is shielded, and that the cable shielding is connected to earth ground at the ImPulse controller and motor. Shielded cable aids in reducing radio frequency interference of other equipment.
2) Wire ImPulse control to the main power panel using the appropriate size wire and circuit breaker as specified in the table above.
3) Installing Probe assembly:

   A 1.5" diameter hole is required in the receiver lid for Probe Assembly to fit through. Insert the probe through the plexi glass receiver cover and press the rubber grommet firmly into the hole. Position the float in the receiver to avoid the milk entry points. This will minimize float sensing problems during washing caused by turbulence. Connect the float assembly cable to the ImPulse CL controller as shown in the Control Wiring Diagram.

OPTIONAL EQUIPMENT - OVERFLOW ALARM

An Overflow Alarm is an optional addition to your system. It will sound an audible alarm and flash a strobe to alert if receiver starts to flood. The alarm will also sound if the inverter shuts off due to trip code, alerting the user to an issue with the controller.

There are two types of alarms to choose from as shown below.

Note: Both alarms should be wired as follows:

Connect the Alarm's 24 VDC (+)Input to Terminal #6 and Alarm's 24 VDC (-)Input to Terminal #10.

#R35505NP - Amber Strobe
#R35506NP - Red Strobe

Deluxe Overflow Alarm
24 VDC Overflow Alarm is an audible alarm with a strobe that comes with a 100 to 240VAC Input Adapter Base. Specify Red or Amber Strobe.

FEATURES :

- 32 adjustable tones with volume up to 110 dB at 1 meter
- 2 tones from one alarm
- Base: 103mm tall IP65 with PG16 entry
- Acoustical frequency range for the 32 tones is .4 to 3.0 KHz
- Temperature range is -10 C to 55 C
- White ABS plastic, polycarbonate lens
- IP54 with short base or IP65 with tall, surface-mount base
- CE approval

#R35510NP - Economy Overflow Alarm
24 VDC

FEATURES :

- One tone - constant or pulsing
- Red LED light - flashing or solid
- Small waterproof IP65 enclosure box
- 98 dB level

Probe Failure Alarm Feature

The ImPulse CL comes with the Alarm Trip DISABLED.

If you want to alert the ImPulse CL to an issue with the Probe Signal, you must change the following Parameter Setting.

Parameter M07.P0007 is set for 4-20mA (disabled). Changing it to 4-20mA Trip instructs system to set off the alarm if there is a probe issue such as no signal or open connection.

If installing an ImPulse CL Probe into a Milk/Wash Reservoir, and you need to disconnect the probe for Wash Fill, leave it as DISABLED or refer to the other method below.

Milk/Wash Receiver System Pump Disable during Wash Fill

You will need to open the Connection on one of the white wires shown below to stop the Run and put the ImPulse CL into "Inhibit" Mode.

Four White Jumper wires: Two from #17 main Control Terminal to Safe Torque Terminals #31 and #34.
Two more from #1 Main Control Terminal to Safe Torque Terminals #32 & #33

Note: The main display will show "Ready" with the above white jumpers installed. It will display "Inhibit" if not installed

Connect a Relay to that connection when the Vacuum Pump is turned Off that it puts the ImPulse CL into Inhibit Mode.

MILK MODE OPERATION SEQUENCE

The following is the operation of the preprogrammed settings. These settings can all be readjusted to best suit your system's pumping needs. Parameter settings may need adjusting depending on the following:

- Receiver type or size
- Type of Milk Pump used
- Whether system is under vacuum
- Amount of head pressure.

Operation Sequence - *Note further parameter setting details on Page 29.*

1. The float rises off the bottom and when it's 15% of the way up the pump it will turn on and accelerate in 3 seconds to the minimum speed of 36 HZ. (Parameter settings 18.011 and 18.012; 00.0031 and 00.004)

   Tip *- Set this frequency level 2 HZ higher than the priming speed you will determine for the pump to achieve the least amount of slippage (churning).*

2. It will stay at minimum speed until it gets up to 25% of the way up from the bottom. (Parameter setting 18.013)

   Tip *- Set this distance range that you prefer to stay at the slowest speed possible to benefit the milk cooling/handling. It's important to make sure the minimum speed HZ is not set too low as you want to insure the best handling of the milk.*

3. After reaching 25% of the way up, every inch of movement up thereafter will make it accelerate linearly until maximum speed distance is reached. (Parameter setting 18.013)

   Tip *- On very small receivers or ones with very low milk inlets you may want to set this lower or equal to the starting point setting.*

4. When the float reaches 60% off the bottom, it will be at 60 HZ full speed. (Parameter setting 18.014 and 18.025)

   Tip *- Set this so maximum speed is reached just below the milk inlets.*

5. When the float is 75% off the bottom near the rubber plug, an alarm can be activated to alert the milk operators to a pending pumping issue before the system traps out. (Parameter setting 18.022)

   Tip *- This can be set to activate at any point you want on the probe during Milk Mode but preferably above the maximum speed arrival point.*

6. The float descending downward from 60% up will change pumping speed slower linearly every inch as it travels until it reaches the 25% point at which it will stay at minimum speed until all the way to the bottom and then stop in 3 seconds. (Parameter setting 18.021)

   Tip *- With Starting distance to pump set higher than the stopping point (bottom), this will alleviate the constant on/off cycling of the milk pump when small amounts of milk enter the system.*

WASH MODE OPERATION SEQUENCE ON A CENTRIFUGAL PUMP

The following is the operation of the preprogrammed settings. These settings can all be readjusted to best suit your system's pumping needs. Parameter settings may need adjusting depending on the following:

- Receiver type or size
- Type of Milk Pump used
- Whether system is under vacuum
- Amount of head pressure.

Operation Sequence - *Note further parameter setting details on Page 30.*

1. The float rises off the bottom 15% of the way up, the pump will turn on and accelerate in 3 seconds to the minimum speed for wash of 45 HZ. NOTE: Starting Point is set by Milk Mode Setting. (Parameter setting 18.015, 18.011, 18.016 and 18.017)

   Tip *- Set starting speed for your best overall speed for best wash water contact in the receiver.*
2. It will stay at minimum speed until it gets up to 20% of the way up from the bottom. (Parameter setting 18.018)

   Tip *- Set this distance higher if more water is needed to wash the trap elbow. It also must be set higher than the Start distance point to work properly.*

   Tip *- On small receivers you may want to set this lower or equal to the starting point.*
3. After reaching 20% of the way up, every inch of movement up thereafter will make it accelerate linearly until maximum speed distance is reached. (Parameter setting 18.018)
4. When the float reaches 25% off the bottom, it will be at 60 HZ full speed. (Parameter setting 18.020)

   Tip *- Set this point higher if trap elbow is not cleaning. If trapping out, set the minimum speed higher.*
5. The float descending downward from 25% up will change pumping speed slower linearly every inch as it travels until it reaches the 20% point at which it will stay at minimum speed until all the way to the bottom and stop in 3 seconds. (Parameter setting 18.021)

   Tip *- Fine tune your system to work best with your longest wash cycle, which is typically the hot water detergent, for best results.*

CONTINUOUS LEVEL FLOAT PROBE FUNCTION

The ImPulse CL Single Float Probes with 1" resolution comes in 4 sizes. Read range is from the top of the Float when resting at the bottom to the bottom of the black rubber Probe Holder.

24" CL Float/Probe (18" read range)	18" = 100%	13.5" = 75%	9" = 50%	4.5" = 25%
30" CL Float/Probe (24" read range)	24" = 100%	18" = 75%	12" = 50%	6" = 25%
40" CL Float/Probe (30" read range)	34" = 100%	25.5" = 75%	17" = 50%	8.5"= 25%
60" CL Float/Probe (54" read range)	54" = 100%	40.5" = 75%	27" = 50%	13.5"= 25%

When trying to calculate the percentage parameter setting for the ImPulse CL Controller's starting point, minimum speed distance and the alarm activation point, calculate the following.

Depending on the Probe you have, use the information below and enter that number inches up from the bottom of the probe to where you want to activate the parameter to function. Then divide the number below. This will give the percentage to enter into the parameter you are setting. To do this properly, measure from the center of the float resting on the bottom to the point on probe you wish to activate.

24" CL Float/Probe—inches divided by .18 = percentage % (Example: 9" ÷ .18 = 50%)

30" CL Float/Probe—inches divided by .24 = percentage % (Example: 12" ÷ .24 = 50%)

40" CL Float/Probe—inches divided by .34 = percentage % (Example: 17" ÷ .34 = 50%)

60" CL Float/Probe—inches divided by .54 = percentage % (Example: 27" ÷ .54 = 50%)

**** NOTE: When calculating and you end up with a percentage with a decimal point, round up to the nearest whole number to enter it into the parameter setting.***

5 Getting started

This chapter introduces the user interfaces, menu structure and security levels of the drive.

5.1 Understanding the display

The keypad can only be mounted on the drive.

5.1.1 Keypad

The CI-Keypad display consists of up to four rows of text. The upper two rows show the drive status or the menu and parameter number currently being viewed. When in status mode, an area one character wide and four lines high on the right-hand side of the display, is reserved for displaying actions that are active on the drive. The possible active actions are given in Table 5-1.

When the drive is powered up, the lower two rows will show the status mode parameters defined by Status Mode Parameter 1 (11.018) and Status Mode Parameter 2 (11.019).

Figure 5-1 Keypad detail

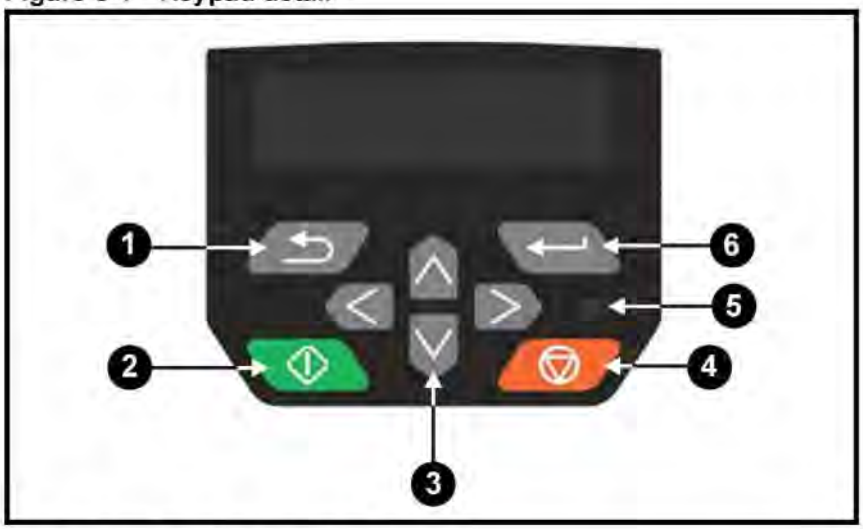


Table 5-1 Key to Figure 5-1

1 Escape button	**4** Stop/Reset button (red)
2 Start button	**5** Status LED
3 Navigation buttons (x4)	**6** Enter button

NOTE

The red stop button is also used to reset the drive.

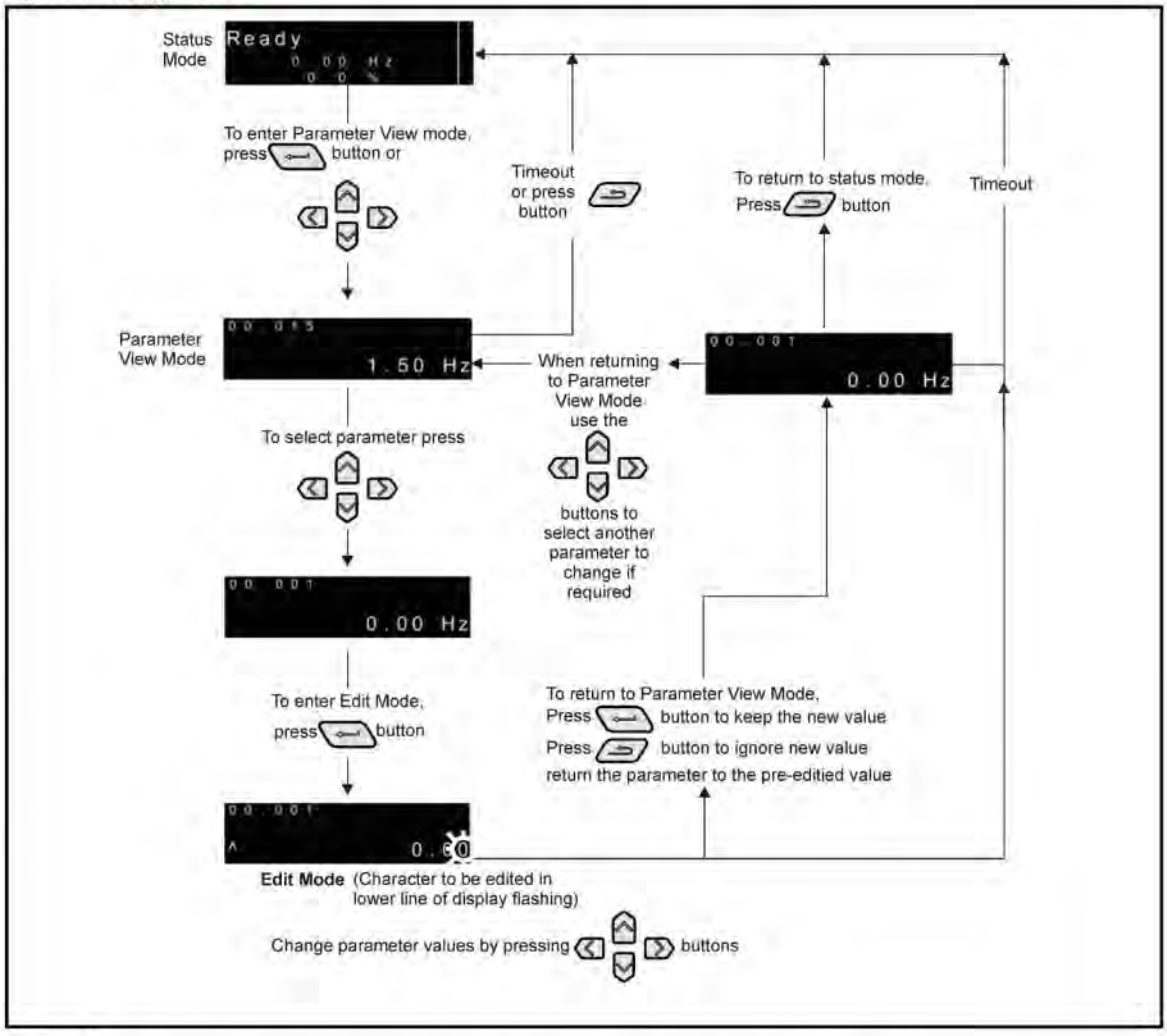
5.2 Keypad operation

5.2.1 Control buttons

The keypad consists of:

- Navigation buttons - Used to navigate the parameter structure and change parameter values.
- Enter / Mode button Used to toggle between parameter edit and view mode.
- Escape / Exit button Used to exit from parameter edit or view mode. In parameter edit mode, if parameter values are edited and the exit button pressed the parameter value will be restored to the value it had on entry to edit mode.
- Start button Used to provide a 'Run' command if keypad mode is selected.
- Stop / Reset button Used to reset the drive. In keypad mode can be used for 'Stop'.

Figure 5-2 Display modes



NOTE

The navigation buttons can only be used to move between menus if Pr **00.010** has been set to show 'All Menus'. Refer to section section 5.8 *Parameter access level and security* on page 64.

NOTE

If the Escape button is held down for 1 second, the display returns to status mode.

5.2.2 Quick access mode

The quick access mode allows direct access to any parameter without scrolling through menus and parameters.

To enter the quick access mode, press and hold the Enter button on the keypad while in 'parameter view mode'.

Figure 5-3 Quick access mode

5.2.3 Keypad shortcuts

In 'parameter view mode':

If the up and down keypad buttons are pressed together, then the keypad display will jump to the start of the parameter menu being viewed, i.e. Pr **05.005** being viewed, when the above buttons pressed together will jump to Pr **05.000**.

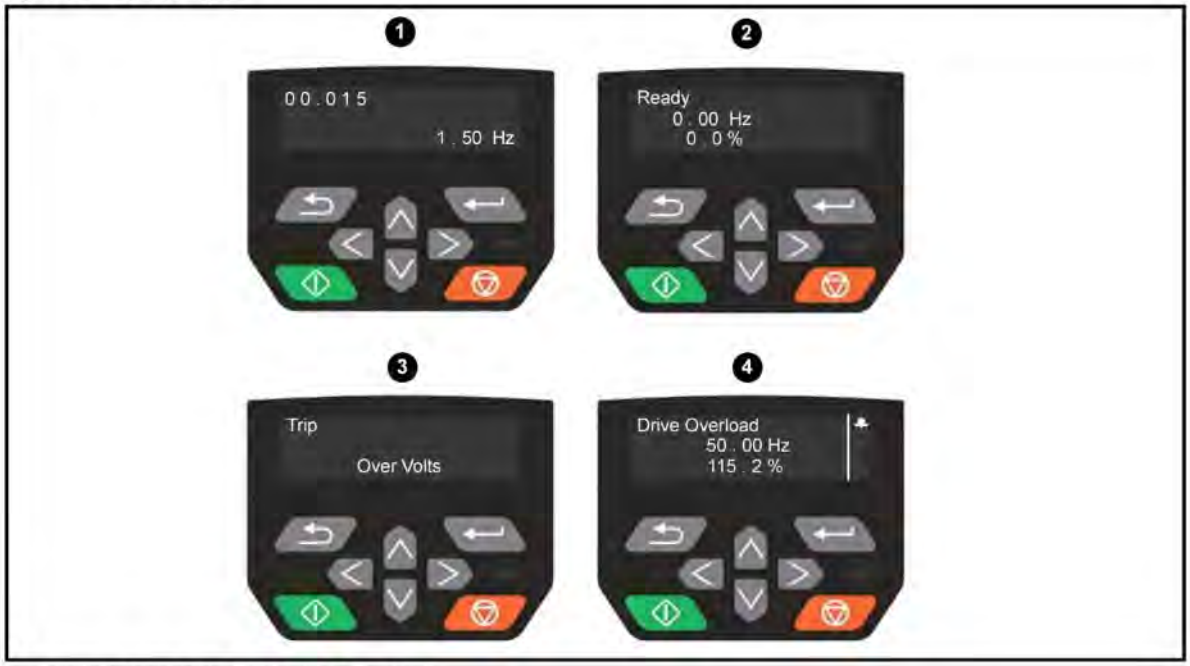
If the left and right keypad buttons are pressed together, then the keypad display will jump to the last viewed parameter in Menu 0.

In 'parameter edit mode':

If the up and down keypad buttons are pressed together, then the parameter value of the parameter being edited will be set to 0.

If the left and right keypad buttons are pressed together, the least significant digit (furthest right) will be selected on the keypad display for editing.

Figure 5-4 Mode examples



1. **Parameter view mode: Read write or Read only**
2. **Status mode: Drive OK status**

If the drive is ok and the parameters are not being edited or viewed, the upper row of the display will show one of the following:

- Inhibit', 'Ready' or 'Run'.

3. **Status mode: trip status**

When the drive is in trip condition, the upper row of the display will indicate that the drive has tripped and the lower row of the display will show the trip code. For further information regarding trip codes, refer to Table 13-2 *Trip indications* on page 174.

4. **Status mode: Alarm status**

During an 'alarm' condition the upper row of the display alternates between the drive status (Inhibit, Ready or Run, depending on what is displayed) and the alarm.

NOTE

When changing the values of parameters, make a note of the new values in case they need to be entered again.

WARNING

Do not change parameter values without careful consideration; incorrect values may cause damage or a safety hazard.

NOTE

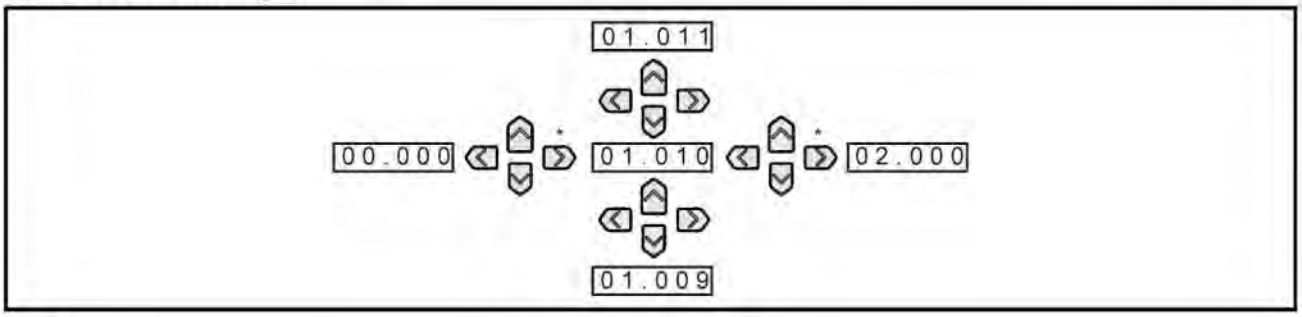
For new parameter values to apply after the line power supply to the drive is interrupted, new values must be saved. Refer to section 5.6 *Saving parameters* on page 64.

5.3 Menu structure

The drive parameter structure consists of menus and parameters.

The drive initially powers up so that only Menu 0 can be viewed. The up and down arrow buttons are used to navigate between parameters and once Pr **00.010** has been set to 'All Menus', the left and right buttons are used to navigate between menus. For further information, refer to section 5.8 *Parameter access level and security* on page 64.

Figure 5-5 Parameter navigation



* Can only be used to move between menus if all menus have been enabled (Pr **00.010**). Refer to section section 5.8 *Parameter access level and security* on page 64.

The menus and parameters roll over in both directions. i.e. if the last parameter is displayed, a further press will cause the display to rollover and show the first parameter. When changing between menus the drive remembers which parameter was last viewed in a particular menu and thus displays that parameter.

WARNING

Do not change parameter values without careful consideration; incorrect values may cause damage or a safety hazard.

NOTE

When changing the values of parameters, make a note of the new values in case they need to be entered again.

NOTE

For new parameter values to apply after the line power supply to the drive is interrupted, new values must be saved. Refer to section 5.6 *Saving parameters* on page 64.

5.3.1 CI-Keypad set-up menu

To enter the keypad set-up menu, press and hold the Escape button on the keypad from status mode. All the keypad parameters are saved to the keypad non-volatile memory when exiting from the keypad set-up menu. To exit from the keypad set-up menu, press the Escape or or button. Below are the keypad set-up parameters.

Table 5-4 CI-Keypad set-up parameters

Parameters		Range	Type
Keypad.00	Language	Classic English or English	RW
Keypad.01	Show Units	Off or On	RW
Keypad.02	Backlight Level	0 to 100 %	RW
Keypad.05	Show Raw Text Parameter Values	Off or On	RW
Keypad.06	Software Version	00.00.00.00 to 99.99.99.99	RO

NOTE

It is not possible to access the keypad parameters via any communications channel.

5.4 Advanced menus

The advanced menus consist of groups or parameters appropriate to a specific function or feature of the drive. Menus 0 to 24 can be viewed on the Keypad.

The option module menu (S.mm.ppp) is only displayed if the option module is installed. Where S signifies the option module slot number and the mm.ppp signifies the menu and parameter number of the option module's internal menus and parameter.

Table 5-5 Advanced menu descriptions

Menu	Description
0	Commonly used basic set up parameters for quick / easy programming
1	Frequency reference
2	Ramps
3	Frequency control
4	Torque and current control
5	Motor control
6	Sequencer and clock
7	Analog I/O
8	Digital I/O
9	Programmable logic, motorized pot, binary sum, timers
10	Status and trips
11	Drive set-up and identification, serial communications
12	Threshold detectors and variable selectors
14	User PID controller
15	Option module slot 1 set-up menu
18	General option module application menu 1
20	General option module application menu 2
21	Second motor parameters
22	Menu 0 set-up
Slot 1	Slot 1 option menus*

* Only displayed when the option module is installed.

5.4.1 Display messages

The following tables indicate the various possible mnemonics which can be displayed by the drive and their meaning.

Table 5-6 Status indications

Upper row string	Description	Drive output stage
Inhibit	The drive is inhibited and cannot be run. The SAFE TORQUE OFF signals are not applied to the SAFE TORQUE OFF terminals or Pr **06.015** is set to 0. The other conditions that can prevent the drive from enabling are shown as bits in Enable Conditions (06.010).	Disabled
Ready	The drive is ready to run. The drive enable is active, but the drive inverter is not active because the final drive run is not active.	Disabled
Stop	The drive is stopped / holding zero frequency.	Enabled
Run	The drive is active and running.	Enabled
Supply Loss	Supply loss condition has been detected	Enabled
Deceleration	The motor is being decelerated to zero frequency because the final drive run has been deactivated.	Enabled
dc Injection	The drive is applying dc injection braking.	Enabled
Trip	The drive has tripped and no longer controlling the motor. The trip code appears in the lower display.	Disabled
Under Voltage	The drive is in the under voltage state either in low voltage or high voltage mode.	Disabled

5.4.2 Alarm indications

An alarm is an indication given on the display by alternating the alarm string with the drive status string on the display. Alarms strings are not displayed when a parameter is being edited.

Table 5-7 Alarm indications

Alarm string	Description
Brake Resistor	Brake resistor overload. *Braking Resistor Thermal Accumulator* (10.039) in the drive has reached 75.0 % of the value at which the drive will trip.
Motor Overload	*Motor Protection Accumulator* (04.019) in the drive has reached 75.0 % of the value at which the drive will trip and the load on the drive is >100 %.
Drive overload	Drive over temperature. *Percentage Of Drive Thermal Trip Level* (07.036) in the drive is greater than 90 %.
Auto Tune	The autotune procedure has been initialized and an autotune in progress.
Limit Switch	Limit switch active. Indicates that a limit switch is active and that is causing the motor to be stopped.
Option Slot 1	Option slot alarm.
Low AC	Low voltage mode. See Low AC Alarm (10.107).
Current Limit	Current limit active. See Current Limit Active (10.009).

PROGRAMMING

The ImPulse CL unit is programmed for use with centrifugal milk pumps, however, if using on other types of milk pumps such as diaphragm, positive displacement or lobe pumps, please call us for programming suggestions at (800) 729-4118.

Power Up

Make sure the float is setting on the lower retainer and apply power to the ImPulse controller. When the unit powers up, it should show “Ready 0.00Hz” and “0.00 RPM” on the display with the float at the bottom. The pump motor should not begin to run. If it does check the position of the float on the probe. When the float is lifted, the display should change from “Ready to Run” and show the speed it is running. It is measured in Hz.

Motor Rotation

Remove the receiver lid and probe assembly from the receiver. Dump some water into the receiver to lubricate the pump seals. While looking at the motor fan, briefly lift the float off the lower retainer of the probe assembly to start the motor and note the motor rotation. If the rotation is incorrect, switch wires M1 and M2 on the terminal block in the ImPulse controller. Re-check the motor rotation. Replace receiver cover.

Motor Parameters

You must enter the nameplate amperage for the motor being used into Parameter #00.006.

Setting Minimum Motor Speed - Factory setting = 36 Hz (Parameter setting 18.012)

The minimum milk pump motor speed should be set slightly above the speed where the pump starts to pump milk. This is determined in the following way:

1. Determine a method to supply water to the receiver while the system is in the milking mode. One suggestion is to use the wash vat and add water line or milking units to supply water. Close all of the shutoff (vacuum or pinch) valves to the milking units. This method is recommended instead of trying to make adjustment during washing as the air injector and lower vacuum levels will effect pump performance.
2. Turn vacuum pump on and set ImPulse to Wash Mode and run water into the receiver . Allow the pump to cycle until the milk discharge line to the wash vat is filled. Now set ImPulse CL to Milk Mode.

3) Allow a steady flow of water to enter the receiver so that the milk pump runs continuously at low speed. (Factory setting is 36 Hz.) If additional water is needed, open the shutoff valve to a milking unit.

4) Observe the milk discharge line at the wash vat. Is water being pumped?

   If "NO", proceed to step A, otherwise go to step B.

   A) Change Parameter M18.P012—Minimum/Start speed to increase the value by one unit. Observe if water is being pumped though the discharge line at the wash vat. Wait 15-20 seconds for system to stabilize. If not, increase data value by one unit. Continue until water just starts to flow from discharge line. Proceed to step 5.

   B) If the water is being pumped, proceed as follows:

   Change Parameter M18.P012 and decrease the data value until the pump stops discharging water into the wash vat, then go to steps 4A.

5) Once minimum pumping speed is determined, increase the data value by one unit and save data to memory.

MILKING SIMULATION

Allow water to flow into the receiver to simulate a group of cows being milked. The milk pump speed should slowly increase when the float rises. This cycle will continue to repeat depending on inflow into the receiver. When water inflow is less than pump outflow, the pump will stop.

WASHING TEST RUN

1) Set the milking system up for washing and set the switch to WASH.

2) Run the system through a wash cycle and check to be sure the milk pump runs and keeps from trapping out during the Detergent Cycle and the Trap Elbow is getting clean. A little wash water should enter into the trap for proper cleaning.

FINDING THE OPTIMUM PUMP SPEED FOR MILKING

In the setup of the minimum speed for pumping, it is important to find the optimum speed here. Do not just set it at the speed it pumps slowest at to find out a little increase in speed greatly increases the pump output. The minimum speed should be set at the HZ that is proportional and linear to the overall best performance curve of the Pump in its application. It should not be set at or too near the threshold (cutoff) point of pumping to not pumping on the setup, for this could lead to unwanted increased churning of the milk.

Also the new ImPulse CL Controller with its separate Milk and Wash setups, the Milk cycle will be able to have its own top speed setting. If properly set, it will be able to lock it into the best optimum pumping zone for milk. But with the separate Wash mode, it will still allow the higher speeds if needed for the wash cycles.

We want make to be sure these controllers are installed correctly and tuned in for the best milk overall performance and handling for optimum results.

Parameter M07.P001

You can view where the float is at while the system is running to see if it's running at the correct speed or at the right level. It shows a reading of 0-100%.

Example: If showing at 50% on a 24" CL Probe with an 18" Read Range, it will be at 9" off the bottom.

USER PARAMETER SETTINGS FOR IMPULSE CL ON CENTRIFUGAL PUMP

Parameters listed below are pre-programmed at the settings listed below. Note when the Inverter's display shows "Trip User Program 6", a wrong setting has been entered. Often this will happen after it has run that function for that parameter.

Electric Motor Settings M - Menu # P - Parameter #	**User Settings**	**Parameter Function**
M00.P006	7.5/2HP 230V	Nameplate current on the electric motor

Milk Mode M - Menu # P - Parameter #	**User Settings**	**Parameter Function**
M00.P001	18	Minimum and starting speed for the analog signal in HZ. Can be adjusted if needed to smooth out the transition to continuous speed to variable. Set lower than Start Hz.
M00.P003	3	Milk acceleration rate in seconds. Adjustment Range 3 to 20 seconds.
M00.P004	3	Milk deceleration rate in seconds. Adjustment Range 3 to 20 seconds.
M01.P026	60	This is the speed for the manual pump out switch in HZ. Adjustment Range 30Hz to 60Hz and must be set the same or lower than M18.P025 Milk maximum speed.
M18.P011	1500	Milk level to start in analog percentage 1500 is 15.00% of the distance of the probe from the bottom. (Also affects the Wash Mode.) Adjustment Range 1% (100) to 15% (1500).
M18.P012	3600	Milk minimum/start speed in hz 3600 = 36.00 Hz. Adjustment Range 15 Hz (1500 to 50Hz (5000.)

Milk Mode M - Menu # P - Parameter #	User Settings	Parameter Function
M18.P013	2500	Milk level transition distance in analog percentage 2500 = 25.00% of the distance of the probe from the bottom. This is the distance from where it will hold the starting Hz speed up to before it goes variable speed per inch of movement. Adjustment Range 15% (1500 to 50% (5000) must be set higher than distance to start by at least 500, but not higher than distance to max speed.
M18.P014	166	Milk level to max speed. 100 divided by percentage point on probe to get to maximum speed = scaling number to enter here. 100% dived by 60% = 1.66 = 166 for setting. Adjustment Range 50% (200) to 80% (125) must be set higher than transition distance.
M18.P025	60	Milk maximum speed 60 = 60 Hz at 3600 RPMs. Adjustment Range 50Hz - 100 Hz must be set higher than Milk minimum/start speed.
M18.P022	7500	Percentage of analog to turn on high level alarm output 7500 = 75.0% this works in Milk Mode only. Adjustment Range 50% (5000) to 100% (10000) must be set higher than distance to max speed.
M18.P021	200	Distance to stop affects both Milk and Wash. Percentage of analog level. 200 = 2.0%. Adjustment Range 2.0% to 5.0%.

Wash Mode M - Menu # P - Parameter #	User Settings	Parameter Function
M18.P015	6000	Wash minimum/start speed in Hz 4500 = 45 Hz. Adjustment Range 35 Hz (3500) to 100 Hz (6000).
M18.P016	6	Wash acceleration rate. Multiply by 2 the number of seconds at which you wish to accelerate. Adjustment Range 5 to 40.
M18.P017	6	Wash deceleration rate. Multiply by 20 the number of seconds at which you wish to decelerate. Adjustment Range 5 to 40.

Wash Mode M - Menu # P - Parameter #	NuPulse Settings	Parameter Function
M18.P018	2500	Wash level transition distance in analog percentage 2500—25.00%. Adjustment Range 15% (1500) to 50% (5000) must be set higher than distance to start by at least 500, but not higher than distance to max speed.
M18.P019	60	Wash max speed 60 = 60 Hz at 3600 RPMs. Adjustment Range 50 Hz to 100 hz must be set higher than Wash minimum/start speed.
P18.P020	400	Wash level to max speed. 100 divided by percentage point on probe to get to maximum speed = Scaling number to enter here. 100% divided by 90% = 1.11 = 111 FOR SETTING. Adjustment Range 25% (400) to 100% (100) must be set higher than Wash transition distance.

TO SAVE PARAMETER CHANGES

Go to "Menu15.000" to save these parameter settings.

- Press the Enter Button Arrow key - it will show a flashing "No Action".
- Press the Up Arrow key once to show a flashing "Save parameters".
- Press the Enter Button Arrow key to stop the flashing.
- Press the Red Stop/Reset key to save these settings.

Press the Escape Arrow Return key to get to the Main Display that should show "Ready 0.00 hz and 0 RPM".

TO Default Settings to Our Original Programed Parameters

Go to Parameter "M18.035"

- Press the Enter Button Arrow key - it will show a flashing "No" change it to "Yes"
- Press the Enter Button Arrow key to stop the flashing.
- Repeat the above and save your changes or re-enter the New Parameter Settings then save.

Press the Escape Arrow Return key to get to the Main Display that should show "Ready 0.00 hz and 0 RPM".

QUICK LIST of FACTORY PARAMETER SETTINGS FOR IMPULSE CL CENTRIFUGAL PUMPS

If any changes are made to the factory settings listed below, it is important to document in space provided and specify what changes were made. This is for future reference and will assist with trouble shooting the system if needed.

Remember to Save any Changes in the Drive Memory see page 29.

Setting Location M - Menu # P - Parameter #	**Parameters Set by NuPulse**	**Parameter Setting Changes**
M00.P001	18	
M00.P003	3	
M00.P004	3	
M00.P006	7.5	
M00.P007	3600	
M01.P026	60	
M18.P011	1500	
M18.P012	3600	
M18.P013	2500	
M18.P014	166	
M18.P015	6000	
M18.P016	6	
M18.P017	6	
M18.P018	2500	
M18.P019	60	
M18.P020	400	
M18.P021	200	
M18.P022	7500	
M18.P023	600	
M18.P024	60 (PD Pump CIP)	
M18.P025	60 (PD Pump CIP)	
M18.P027	60 (PD Pump CIP)	

Charts for programing the ImPulse CL Probes on Receivers with low Inlets

24” Probe			
Inlet Height	Parameter Setting 18.011	Parameter Setting 18.013	Parameter Setting 18.014
4”	500	1000	600
5	600	1100	480
6”	700	1200	360
7”	1000	1400	300
8”	1100	1600	260
9”	1200	1900	225
10”	1300	2100	199
11”	1400	2300	180
12”	1500	2500	166
13”	1600	2700	150
14”	1700	2900	140

30” Probe			
Inlet Height	Parameter Setting 18.011	Parameter Setting 18.013	Parameter Setting 18.014
4”	500	1000	540
5”	750	1300	460
6”	800	1500	385
7”	1150	1900	340
8”	1200	1975	305
9”	1250	2050	270
10”	1300	2125	235
12”	1400	2375	200
14”	1500	2500	166
16”	1600	2700	145
18”	1700	3100	133
20”	1800	3500	115

NOTE

Minimum Speed in Parameter 18.012 is factory set at 36HZ.

If you change this minimum speed, you then need to change Parameter 00.001 an equal amount in HZ. It is factory set at 18HZ.

Examples:

Parameter 18.012 was changed to 40HZ, set 00.001 to 22HZ.

Parameter 18.012 was changed to 30HZ, set 00.001 to 12HZ.

SAVE PARAMETER CHANGES

Go to “Menu15.000” to save these parameter settings.

· Press the Enter Button Arrow key - it will show a flashing “No Action”.

· Press the Up Arrow key once to show a flashing “Save parameters”.

· Press the Enter Button Arrow key to stop the flashing.

· Press the Red Stop/Reset key to save these settings.

Press the Escape Arrow Return key to get to the Main Display that should show “Ready 0.00 hz and 0 RPM”.

Charts for programing the ImPulse CL Probes on Receivers with low Inlets

40” Probe			
Inlet Height	Parameter Setting 18.011	Parameter Setting 18.013	Parameter Setting 18.014
10”	600	1250	350
11”	650	1375	310
12”	700	1500	285
14”	900	1750	255
16”	1100	2000	217
18”	1300	2250	190
20”	1500	2500	166
24”	1700	3000	142
28”	1900	4000	100

60” Probe			
Inlet Height	Parameter Setting 18.011	Parameter Setting 18.013	Parameter Setting 18.014
10”	500	1000	540
11”	550	1150	480
12”	600	1300	440
14”	750	1500	390
16”	875	1750	340
18”	950	2000	295
20”	1100	2125	265
24”	1250	2250	220
28”	1400	2375	190
32”	1500	2500	166
36”	1600	2625	145

NOTE

Minimum Speed in Parameter 18.012 is factory set at 36HZ.

If you change this minimum speed, you then need to change Parameter 00.001 an equal amount in HZ. It is factory set at 18HZ.

Examples:

Parameter 18.012 was changed to 40HZ, set 00.001 to 22HZ.

Parameter 18.012 was changed to 30HZ, set 00.001 to 12HZ.

SAVE PARAMETER CHANGES

Go to “Menu15.000” to save these parameter settings.

· Press the Enter Button Arrow key - it will show a flashing “No Action”.

· Press the Up Arrow key once to show a flashing “Save parameters”.

· Press the Enter Button Arrow key to stop the flashing.

· Press the Red Stop/Reset key to save these settings.

Press the Escape Arrow Return key to get to the Main Display that should show “Ready 0.00 hz and 0 RPM”.

IMPULSE CL POWER CONSUMPTION MONITORING

Set the following Parameter to analyze power consumption of the VSD.

M06.P027 = 13 - Energy Cost per kWh. Enter in cost in cents (Example: WI average is $0.13 kWh).

You can view the following at the parameters listed below. M - Menu # P - Parameter #		
	View	**Parameter Function**
M06.P028	Running Cost in Cents	Cost in cents average if it ran one hour at this speed.
M06.P025	Energy Meter MWh	MWh = Megawatts used.
M06.P026	Energy Meter kWh	kWh = Kilowatts used.
M04.P001	Output Current	Output current to the electric motor in Amps.
Reset the following Parameter to Reset and clear the Watt Meters		
M06.P024	Reset Clear	Change to “ON” then back to “OFF” again will clear the Watt Meters.

IMPULSE CL ALARM / TRIP CODES

To view history of the last Trip Code and History of previous 9 other codes, go to the following Parameters in the Inverter.

Trip Code Location M - Menu # P - Parameter #	**Trip Code History**
M10.P020	0 = Last Trip Code
M10.P021	1
M10.P022	2
M10.P023	3
M10.P024	4
M10.P025	5
M10.P026	6
M10.P027	7
M10.P028	8
M10.P029	9

Diagnostics from Emerson Unidrive M400 User Guide can be found on following pages.

Hardware Fault (HF) Codes on M400 Drives

If you receive an HF Code, first try to clear code using Reset Key. If that does not clear code, turn power off to inverter for 5 minutes, then turn power back on.

For a Hard Reset for, enter a "1299" into any "00" Parameter. If drive won't run, check to be sure that Parameter 11.047 is set for "Run".

If code still appears, the drive will need to be replaced.

Trouble Shooting

ImPulse CL System will not Stop and Running Minimum Speed 0r Higher

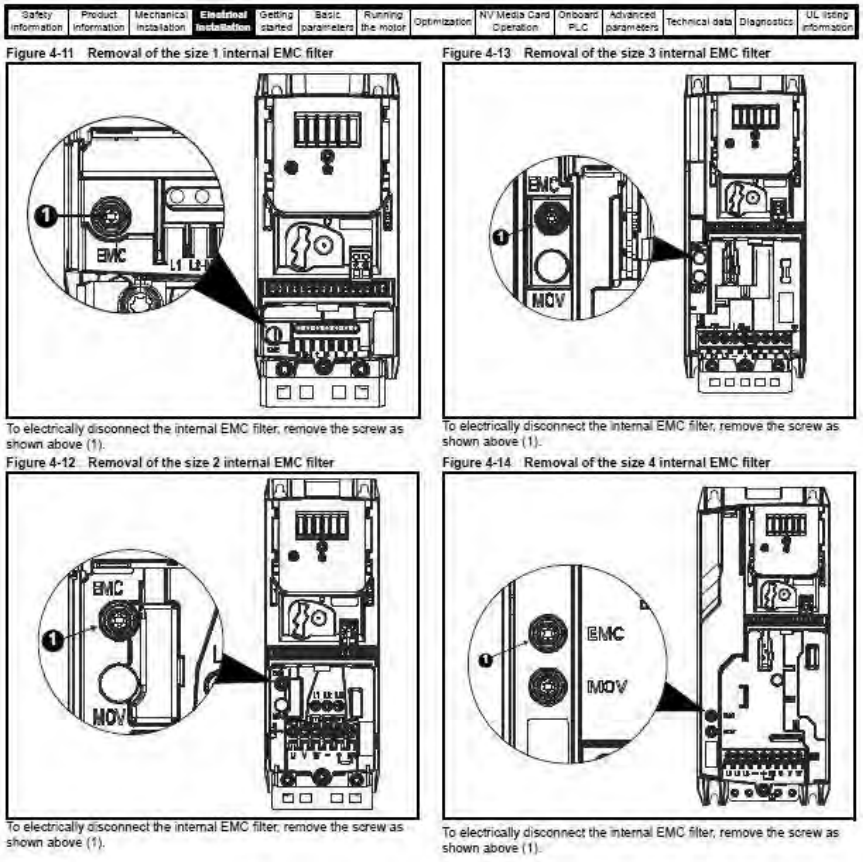
If the CL System will not shut off with the Float at the bottom and go to Parameter # M07.P001 this will put the display into Analog to show it in percentage. (0% - 100%).

With the Float at the bottom Stopper (lowest point) it should read below 1%.

If it is below 1% go to Parameter “18:021” this is the distance from the bottom that it is suppose to stop at. Make sure that it is set at 2 (%) or higher. (Normal settings are 2 – 5%).

If it is higher than 1% the Probe could possibly be defective and need replacement, but if the reading is varying to higher speeds or stops when removed from the Milk Receiver it is more likely an Interference Issue.

You can disconnect or connect the Shield from the CL Probe Wire to see if it has an effect. But if it doesn’t, disabling the built in EMC Filter by removing the Torx Screw shown below. This will normally resolve an issue with the 4 to 20 mA signal Interference issue with CL Probe.



Trouble Shooting

ImPulse CL Alarm / Trip Codes

You can look up the Trip History on the Inverter by going to the Parameters listed below.

10.020	Trip 0	0 to 255
10.021	Trip 1	0 to 255
10.022	Trip 2	0 to 255
10.023	Trip 3	0 to 255
10.024	Trip 4	0 to 255
10.025	Trip 5	0 to 255
10.026	Trip 6	0 to 255
10.027	Trip 7	0 to 255
10.028	Trip 8	0 to 255
10.029	Trip 9	0 to 255

Trip "0" is the latest Alarm Trip and Trip "9" is the oldest.

See the pages 41 to 51 for their description.

The Parameters listed below will assist you in trouble shooting.

Parameter M07.P001

You can view where the float is at while the system is running to see if it's running at the correct speed or at the right level. It shows a reading of 0-100%.

Example: If showing at 50% on a 24" CL Probe with an 18" Read Range, it will be at 9" off the bottom.

Parameter M04.P001

This will display the output Current Draw of the electric motor. This can tell you if you have an over-loaded motor.

13 Diagnostics

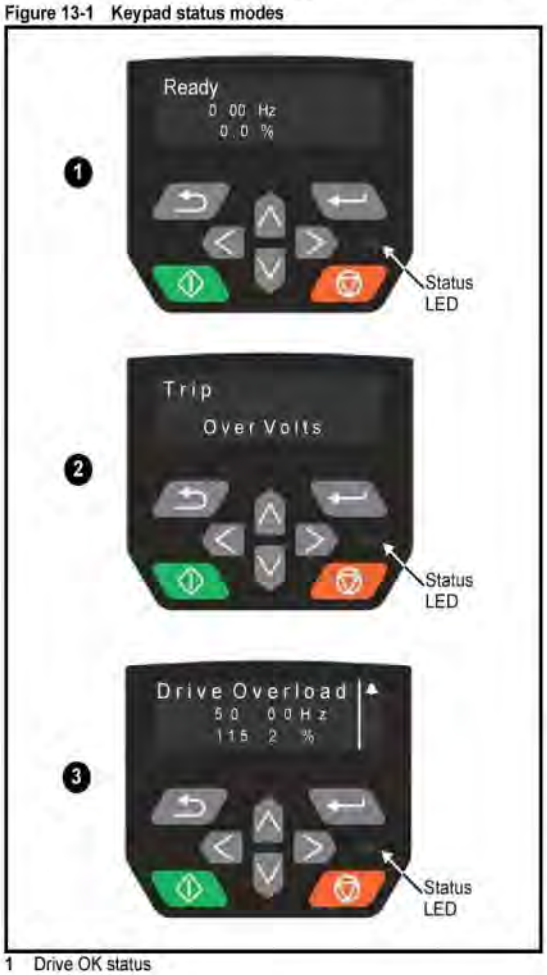
The keypad display on the drive gives various information about the status of the drive. The keypad display provides information on the following categories:

- Trip indications
- Alarm indications
- Status indications

> **WARNING** Users must not attempt to repair a drive if it is faulty, nor carry out fault diagnosis other than through the use of the diagnostic features described in this chapter.
> If a drive is faulty, it must be returned to an authorized Control Techniques distributor for repair.

13.1 Status modes (Keypad and LED status)

Figure 13-1 Keypad status modes



1 Drive OK status
2 Trip status
3 Alarm status

13.2 Trip indications

The output of the drive is disabled under any trip condition so that the drive stops controlling the motor. If the motor is running when the trip occurs it will coast to a stop.

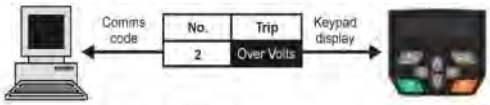
During a trip condition, where a CI-Keypad is being used, the upper row of the display indicates that a trip has occurred and the lower row of the keypad display will show the trip string. Some trips have a sub-trip number to provide additional information about the trip. If a trip has a sub-trip number, the sub-trip number is flashed alternately with the trip string unless there is space on the second row for both the trip string and the sub-trip number in which case both the trip string and sub-trip information is displayed separated by a decimal point.

If a display is not being used , the drive LED Status indicator will flash with 0.5 s duty cycle if the drive has tripped. Refer to Figure 13-2 *Key to sub-trip number* .

Trips are listed alphabetically in Table 13-3 *Serial communications look up table* on page 190 based on the trip indication shown on the drive display. Alternatively, the drive status can be read in Pr **10.001** 'Drive OK' using communication protocols. The most recent trip can be read in Pr **10.020** providing a trip number. It must be noted that the hardware trips (HF01 to HF19) do not have trip numbers. The trip number must be checked in Table 13-3 to identify the specific trip.

Example

1. Trip code 2 is read from Pr **10.020** via serial communications.
2. Checking Table 13-2 shows Trip 2 is an Over Volts trip.



3. Look up Over Volts in Table 13-2.
4. Perform checks detailed under *Diagnosis*.

13.3 Identifying a trip / trip source

Some trips only contain a trip string whereas some other trips have a trip string along with a sub-trip number which provides the user with additional information about the trip.

A trip can be generated from a control system or from a power system. The sub-trip number associated with the trips listed in Table 13-1 is in the form xxyzz and used to identify the source of the trip.

Table 13-1 Trips associated with xxyzz sub-trip number

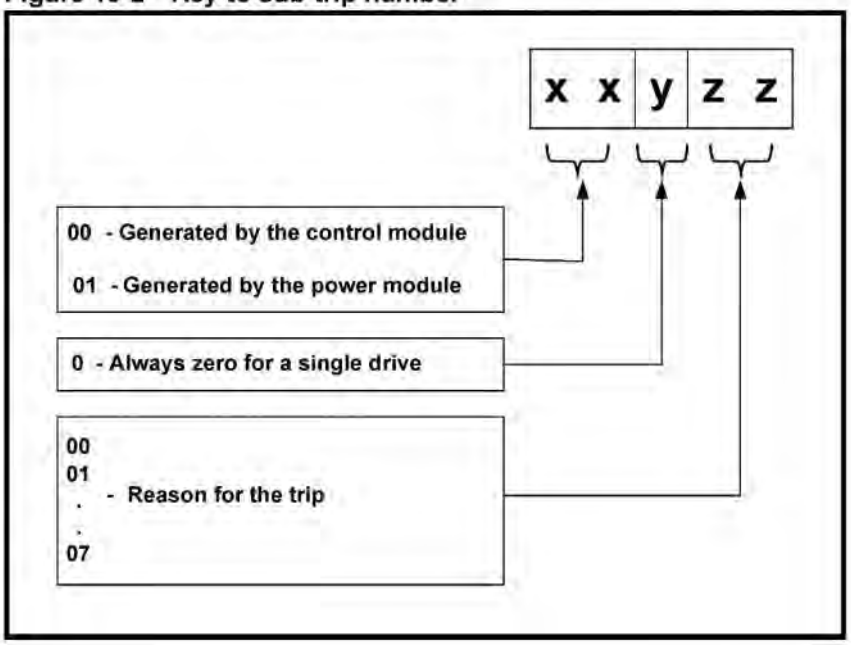
Over Volts	Phase Loss
OI ac	Power Comms
OI Brake	OI Snubber
PSU	OHt Rectifier
OHt Inverter	Temp Feedback
OHt Power	Power Data
OHt dc bus	Soft Start

The digits xx are 00 for a trip generated by the control system. For a drive, if the trip is related to the power system then xx will have a value of 01, when displayed the leading zeros are suppressed.

For a control system trip (xx is zero), the y digit where relevant is defined for each trip. If not relevant, the y digit will have a value of zero.

The zz digits give the reason for the trip and are defined in each trip description.

Figure 13-2 Key to sub-trip number



13.4 Trips, Sub-trip numbers

Table 13-2 Trip indications

Trip	Diagnosis
An Input 1 Loss	**Analog input 1 current loss**
28	The *An Input 1 Loss* trip indicates that a current loss was detected in current mode on Analog input 1 (Terminal 2). In 4-20 mA and 20-4 mA modes loss of input is detected if the current falls below 3 mA. **Recommended actions:** • Check control wiring is correct • Check control wiring is undamaged • Check the *Analog Input 1 Mode* (07.007) • Current signal is present and greater than 3 mA
An Input 1 OI	**Analog input 1 over-current**
189	Current input on analog input 1 exceeds 24mA.
An Input 2 Loss	**Analog input 2 current loss**
29	The *An Input 2 Loss* trip indicates that a current loss was detected in current mode on Analog input 2 (Terminal 5). In 4-20 mA and 20-4 mA modes loss of input is detected if the current falls below 3 mA. Recommend actions: • Check control wiring is correct • Check control wiring is undamaged • Check the Analog Input 2 Mode (07.011) • Current signal is present and greater than 3 mA
An Input 2 OI	**Analog input 2 over-current**
190	Current input on analog input 2 exceeds 24 mA.

Data Changing	Drive parameters are being changed
97	A user action or a file system write is active that is changing the drive parameters and the drive has been commanded to enable, i.e. *Drive Active* (10.002) = 1. **Recommended actions:** • Ensure the drive is not enabled when defaults are loading

Derivative ID	Derivative file error
246	Derivative file error with sub-trips: Sub-trip: 1 – Derivative file different Sub-trip: 2 – Derivative file missing

Fan Fail	Fan fail
173	Recommended actions: • Check that the fan is installed and connected correctly. • Check that the fan is not obstructed. • Contact the supplier of the drive to replace the fan.

Hot Rect/Brake	Hot rectifier/brake
250	Over-temperature detected on input rectifier or braking IGBT.

I/O Overload	Digital output overload
26	The *I/O Overload* trip indicates that the total current drawn from 24 V user supply or from the digital output has exceeded the limit. A trip is initiated if the following condition is met: • Maximum output current from one digital output is 100 mA. **Recommended actions:** • Check total loads on digital outputs • Check control wiring is correct • Check output wiring is undamaged
Keypad Mode	**Keypad has been removed when the drive is receiving the reference from the keypad**
34	The *Keypad Mode* trip indicates that the drive is in keypad mode [*Reference Selector* (01.014) = 4 or 6] and the keypad has been removed or disconnected from the drive. **Recommended actions:** • Re-install keypad and reset • Change *Reference Selector* (01.014) to select the reference from another source

Motor Too Hot	Output current overload timed out (I^2t)
20	The *Motor Too Hot* trip indicates a motor thermal overload based on the output current (Pr **05.007**) and motor thermal time constant (Pr **04.015**). Pr **04.019** displays the motor temperature as a percentage of the maximum value. The drive will trip on *It.AC* when Pr **04.019** gets to 100 %. **Recommended actions:** • Ensure the load is not jammed / sticking • Check the load on the motor has not changed • Tune the motor rated speed parameter (Pr **5.008**) (RFC-A mode only) • Ensure the motor rated current is not zero

<table>
<tr><td>OHt Control</td><td>Control stage over temperature</td></tr>
<tr><td>219</td><td>This trip indicates that a control stage over-temperature has been detected if Cooling Fan control (06.045) = 0.
Recommended actions:
• Increase ventilation by setting Cooling Fan control (06.045) > 0</td></tr>
<tr><td>OHt dc bus</td><td>DC bus over temperature</td></tr>
<tr><td>27</td><td>The OHt dc bus trip indicates a DC bus component over temperature based on a software thermal model. The drive includes a thermal protection system to protect the DC bus components within the drive. This includes the effects of the output current and DC bus ripple. The estimated temperature is displayed as a percentage of the trip level in Pr 07.035. If this parameter reaches 100 % then an Oh.dc trip is initiated. The drive will attempt to stop the motor before tripping. If the motor does not stop in 10 seconds the drive trips immediately.
<table>
<tr><th>Source</th><th>xx</th><th>y</th><th>zz</th><th>Description</th></tr>
<tr><td>Control system</td><td>00</td><td>2</td><td>00</td><td>DC bus thermal model gives trip with sub-trip 0</td></tr>
</table>
Recommended actions:
• Check the AC supply voltage balance and levels
• Check DC bus ripple level
• Reduce duty cycle
• Reduce motor load
• Check the output current stability. If unstable;
Check the motor map settings with motor nameplate (Pr 05.006, Pr 05.007, Pr 05.008, Pr 05.009, Pr 05.010, Pr 05.011) – (All Modes)
Disable slip compensation (Pr 05.027 = 0) – (Open loop)
Disable dynamic V to F operation (Pr 05.013 = 0) - (Open loop)
Select fixed boost (Pr 05.014 = Fixed) – (Open loop)
Select high stability space vector modulation (Pr 05.020 = 1) – (Open loop)
Disconnect the load and complete a rotating auto-tune (Pr 05.012)
Reduce frequency loop gains (Pr 03.010, Pr 03.011, Pr 03.012) – (RFC-A)</td></tr>
<tr><td>OHt Inverter</td><td>Inverter over temperature based on thermal model</td></tr>
<tr><td>21</td><td>This trip indicates that an IGBT junction over-temperature has been detected based on a software thermal model.
<table>
<tr><th>Source</th><th>xx</th><th>y</th><th>zz</th><th>Description</th></tr>
<tr><td>Control system</td><td>00</td><td>1</td><td>00</td><td>Inverter thermal model gives {Oht.I} trip with sub-trip 0</td></tr>
</table>
Recommended actions:
• Reduce the selected drive switching frequency
• Ensure Auto-switching Frequency Change Disable (05.035) is set to OFF
• Reduce duty cycle
• Increase acceleration / deceleration rates
• Reduce motor load
• Check DC bus ripple
• Ensure all three input phases are present and balanced</td></tr>
</table>

OHt Power	**Power stage over temperature**
22	This trip indicates that a power stage over-temperature has been detected. From the sub-trip 'xxyzz', the Thermistor location is identified by 'zz'. **Source** | **xx** | **y** | **zz** | **Description** Power system | 01 | 0 | zz | Thermistor location in the drive defined by zz **Recommended actions:** • Check enclosure / drive fans are still functioning correctly • Force the heatsink fans to run at maximum speed • Check enclosure ventilation paths • Check enclosure door filters • Increase ventilation • Reduce the drive switching frequency • Reduce duty cycle • Increase acceleration / deceleration rates • Reduce motor load • Check the derating tables and confirm the drive is correctly sized for the application. • Use a drive with larger current / power rating
OHt Rectifier	**Rectifier over temperature**
102	The *Oht Rectifier* trip indicates that a rectifier over-temperature has been detected. The thermistor location can be identified from the sub-trip number. **Source** | **xx** | **y** | **zz** | **Description** Power system | Power module number | Rectifier number | zz | Thermistor location defined by zz **Recommend actions:** • Check the motor and motor cable insulation with an insulation tester • Fit an output line reactor or sinusoidal filter • Force the heatsink fans to run at maximum speed by setting Pr **06.045** = 1 • Check enclosure / drive fans are still functioning correctly • Check enclosure ventilation paths • Check enclosure door filters • Increase ventilation • Increase acceleration / deceleration rates • Reduce duty cycle • Reduce motor load
OI ac	**Instantaneous output over current detected**
3	The instantaneous drive output current has exceeded VM_DRIVE_CURRENT_MAX. **Source** | **xx** | **y** | **zz** | **Description** Control system | 00 | 0 | 00 | Instantaneous over-current trip when the measured a.c. current exceeds VM_DRIVE_CURRENT[MAX]. **Recommended actions/checks:** • Increase acceleration/deceleration rate • If seen during auto-tune reduce the voltage boost • Check for short circuit on the output cabling • Check integrity of the motor insulation using an insulation tester • Is the motor cable length within limits for the frame size? • Reduce the values in the frequency loop gain parameters - (Pr **03.010**, **03.011**, **03.012**) or (Pr **03.013**, **03.014**, **03.015**) • Reduce the values in the current loop gain parameters

OI Snubber	Snubber over-current detected
92	This trip indicates that an over-current condition has been detected in the rectifier snubbing circuit, The exact cause of the trip can be identified by the sub-trip number. **Source** / **xx** / **y** / **zz** Power system / 01 / 1 / 00: Rectifier snubber over-current trip detected. **Recommended actions:** • Ensure the internal EMC filter is installed. • Ensure the motor cable length does not exceed the maximum for selected switching frequency. • Check for supply voltage imbalance. • Check for supply disturbance such as notching from a DC drive. • Check the motor and motor cable insulation with a Megger. • Fit an output line reactor or sinusoidal filter

OI.dc	Power module over current detected from IGBT on state voltage monitoring
109	The *OI.dc* trip indicates that the short circuit protection for the drive output stage has been activated. **Recommended actions:** • Disconnect the motor cable at the drive end and check the motor and cable insulation with an insulation tester • Replace the drive

Out Phase Loss	Output phase loss detected
98	The *Out Phase Loss* trip indicates that a phase loss has been detected at the drive output. If *Output Phase Loss Detection Enable* (06.059) = 1 then output phase loss is detected as follows: 1. When the drive is enabled short pulses are applied to make sure each output phase is connected. 2. During running the output current is monitored and the output phase loss condition is detected if the current contains more than TBD % negative phase sequence current for TBDs. **Recommended action:** • Check motor and drive connections • To disable the trip set *Output Phase Loss Detection Enable* (06.059) = 0
Output phase s/c	**Output phase short-circuit**
228	Over-current detected on drive output when enabled. Possible motor ground fault. Recommended actions: • Check for short circuit on the output cabling • Check integrity of the motor insulation using an insulation tester • Is the motor cable length within limits for the frame size?

Over Volts	DC bus voltage has exceeded the peak level or maximum continuous level for 15 seconds
2	The *OV* trip indicates that the DC bus voltage has exceeded the VM_DC_VOLTAGE[MAX] or VM_DC_VOLTAGE_SET[MAX] for 15 s. The trip threshold varies depending on voltage rating of the drive as shown below. **Voltage rating** / **VM_DC_VOLTAGE[MAX]** / **VM_DC_VOLTAGE_SET[MAX]** 100 / 415 / 410 200 / 415 / 410 400 / 830 / 815 **Sub-trip Identification** **Source** / **xx** / **y** / **zz** Control system / 00 / 0 / 01: Instantaneous trip when the DC bus voltage exceeds VM_DC_VOLTAGE[MAX]. Control system / 00 / 0 / 02: Time delayed trip indicating that the DC bus voltage is above VM_DC_VOLTAGE_SET[MAX]. Power system / 01 / 0 / 00: Instantaneous trip when the DC bus voltage exceeds VM_DC_VOLTAGE[MAX]. **Recommended actions:** • Increase deceleration ramp (Pr **00.004**) • Decrease the braking resistor value (staying above the minimum value) • Check nominal AC supply level • Check for supply disturbances which could cause the DC bus to rise • Check motor insulation using a insulation tester
Phase Loss	**Supply phase loss**
32	The *Phase Loss* trip indicates that the drive has detected an input phase loss or large supply imbalance. The drive will attempt to stop the motor before this trip is initiated. If the motor cannot be stopped in 10 seconds the trip occurs immediately. The *PH.Lo* trip works by monitoring the ripple voltage on the DC bus of the drive, if the DC bus ripple exceeds the threshold, the drive will trip on PH.Lo. Potential causes of the DC bus ripple are input phase loss, Large supply impedance and severe output current instability. **Source** / **xx** / **y** / **zz** Control system / 00 / 0 / 00: Phase loss detected based on control system feedback. The drive attempts to stop the drive before tripping unless bit 2 of *Action On Trip Detection* (10.037) is set to one. Input phase loss detection can be disabled when the drive is required to operate from the DC supply or from a single phase supply in *Input Phase Loss Detection Mode* (06.047). **Recommended actions:** • Check the AC supply voltage balance and level at full load • Check the DC bus ripple level with an isolated oscilloscope • Check the output current stability • Reduce the duty cycle • Reduce the motor load • Disable the phase loss detection, set Pr **06.047** to 2.

Power Down Save	Power down save error
37	The *Power Down Save* trip indicates that an error has been detected in the power down save parameters saved in non-volatile memory. **Recommended actions:** • Perform a 1001 save in Pr **mm.000** to ensure that the trip doesn't occur the next time the drive is powered up.

Stored HF	Hardware trip has occurred during last power down
221	The *Stored HF* trip indicates that a hardware trip (HF01 –HF19) has occurred and the drive has been power cycled. The sub-trip number identifies the HF trip i.e. stored HF19. **Recommended actions:** • Enter 1299 in Pr **mm.000** and press reset to clear the trip

Table 13-3 Serial communications look up table

No	Trip	No	Trip	No	Trip
1	Reserved	90	LF Power Comms	200	Slot 1 HF
2	Over Volts	91	User 24V	201	Slot 1 Watchdog
3	OI ac	92	OI Snubber	202	Slot 1 Error
4	OI Brake	93	Power Comms	203	Slot 1 Not Fitted
5	PSU	94 - 95	Reserved	204	Slot 1 Different
6	External Trip	96	User Prog Trip	205 - 214	Reserved
7	Over Speed	97	Data Changing	215	Option Disable
8	User OI ac	98	Out Phase Loss	216 - 217	Reserved
9	Reserved	99	Reserved	218	Temp Feedback
10	Th Brake Res	100	Reset	219	OHt Control
11	Reserved	101	OHt Brake	220	Power Data
12	Reserved	102	OHt Rectifier	221	Stored HF
13	Autotune	103 - 108	Reserved	222	Reserved
14 - 17	Reserved	109	OI dc	223 - 224	Reserved
18	Autotune Stopped	110 - 111	Reserved	225	Current Offset
19	Brake R Too Hot	112 - 167	t112 - t167	226	Soft Start
20	Motor Too Hot	168 - 172	Reserved	227	Sub-array RAM
21	OHt Inverter	173	Fan Fail	228	Output phase s/c
22	OHt Power	174	Card Slot	229	Reserved
23	Reserved	175	Card Product	230	Reserved
24	Thermistor	176	Reserved	231	I cal. range
25	Th Short Circuit	177	Card Boot	232	Drive config
26	I/O Overload	178	Card Busy	233	Reserved
27	OHt dc bus	179	Card Data Exists	234	STO Error
28	An Input 1 Loss	180	Card Option	235	Power Board HF
29	An Input 2 Loss	181	Card Read Only	236	No power board
30	Watchdog	182	Card Error	237	FW incompatible
31	EEPROM Fail	183	Card No Data	238 - 245	Reserved
32	Phase Loss	184	Card Full	246	Derivative ID
33	Resistance	185	Card Access	247	File changed
34	Keypad Mode	186	Card Rating	248	Derivative Image
35	Control Word	187	Card Drive Mode	249	User Program
36	User Save	188	Card Compare	250	Hot Rect/Brake
37	Power Down Save	189	An Input 1 OI	252 - 254	Reserved
38	Reserved	190	An Input 2 OI	255	Reset logs
39	Reserved	191 - 198	Reserved		
40 - 89	t040 - t089	199	Destination		

The trips can be grouped into the following categories. It should be noted that a trip can only occur when the drive is not tripped or is already tripped but with a trip with a lower priority number.

Table 13-4 Trip categories

Priority	Category	Trips	Comments
1	Internal faults	HF01, HF02, HF03, HF04, HF05, HF06, HF07, HF08, HF09, HF10, HF11, HF12, HF13, HF14, HF15, HF16, HF17, HF 18, HF 19	These indicate internal problems and cannot be reset. All drive features are inactive after any of these trips occur.
1	Stored HF trip	{Stored HF}	This trip cannot be cleared unless 1299 is entered into *Parameter* (**mm.000**) and a reset is initiated.
2	Non-resettable trips	Trip numbers 218 to 247, {Slot 1 HF}	These trips cannot be reset.
3	Volatile memory failure	{EEPROM Fail}	This can only be reset if Parameter **mm.000** is set to 1233 or 1244, or if *Load Defaults* (11.043) is set to a non-zero value.
4	NV Media Card trips	Trip numbers 174, 175 and 177 to 188	These trips are priority 5 during power-up.
4	Internal 24V	{PSU}	
5	Trips with extended reset times	{OI.ac}, {OI.Brake}, {OI.dc} and {Fan Fail}	These trips cannot be reset until 10 s after the trip was initiated.
5	Phase loss and d.c. link power circuit protection	{Phase Loss} and {OHt dc bus}	The drive will attempt to stop the motor before tripping if a {Phase Loss}. 000 trip occurs unless this feature has been disabled (see *Action On Trip Detection* (10.037). The drive will always attempt to stop the motor before tripping if an {OHt dc bus} occurs.
5	Standard trips	All other trips	

13.5 Internal / Hardware trips

Trips {HF01} to {HF19} are internal faults that do not have trip numbers. If one of these trips occurs, the main drive processor has detected an irrecoverable error. All drive functions are stopped and the trip message will be displayed on the drive keypad. If a non permanent trip occurs this may be reset by power cycling the drive. On power up after it has been power cycled, the drive will trip on Stored HF. Enter 1299 in **mm.000** to clear the Stored HF trip.

13.6 Alarm indications

In any mode, an alarm is an indication given on the display by alternating the alarm string with the drive status string display. If an action is not taken to eliminate any alarm except "tuning and LS" the drive may eventually trip. Alarms are not displayed when a parameter is being edited.

Table 13-5 Alarm indications

Alarm string	Description
Brake Resistor	Brake resistor overload. *Braking Resistor Thermal Accumulator* (10.039) in the drive has reached 75.0 % of the value at which the drive will trip.
Motor Overload	*Motor Protection Accumulator* (4.019) in the drive has reached 75.0 % of the value at which the drive will trip and the load on the drive is >100 %.
Drive Overload	Drive over temperature. *Percentage of Drive Thermal Trip Level* (07.036) in the drive is greater than 90 %.
Auto Tune	The autotune procedure has been initialized and an autotune in progress.
Limit Switch	Limit switch active. Indicates that a limit switch is active and that is causing the motor to be stopped.
Option Slot 1	Option slot alarm
Low AC	Low voltage mode. See *Low AC Alarm* (10.107).
Current limit	Current limit active. See *Current Limit Active* (10.009).

13.7 Status indications

Table 13-6 Status indications

Upper row string	Description	Drive output stage
Inhibit	The drive is inhibited and cannot be run. The SAFE TORQUE OFF signals are not applied to the SAFE TORQUE OFF terminals or Pr **06.015** is set to 0. The other conditions that can prevent the drive from enabling are shown as bits in *Enable Conditions* (06.010).	Disabled
Ready	The drive is ready to run. The drive enable is active, but the drive inverter is not active because the final drive run is not active.	Disabled
Stop	The drive is stopped / holding zero frequency.	Enabled
Run	The drive is active and running.	Enabled
Supply Loss	Supply loss condition has been detected.	Enabled
Deceleration	The motor is being decelerated to zero frequency because the final drive run has been deactivated.	Enabled
dc Injection	The drive is applying dc injection braking.	Enabled
Trip	The drive has tripped and no longer controlling the motor. The trip code appears in the lower display.	Disabled
Under Voltage	The drive is in the under voltage state either in low voltage or high voltage mode.	Disabled

Table 13-7 Option module and other status indications at power-up

First row string	Second row string	Status
Waiting For	Power System	Waiting for power stage
The drive is waiting for the processor in the power stage to respond after power-up.		
Waiting For	Option	Waiting for an option module
The drive is waiting for the option module to respond after power-up		
Uploading From	Option	Loading parameter database
At power-up it may be necessary to update the parameter database held in the drive because an option module has changed. This may involve data transfer between the drive and option module. During this period 'Uploading From Option' is displayed.		

13.8 Displaying the trip history

The drive retains a log of the last ten trips that have occurred. *Trip 0* (10.020) to *Trip 9* (10.029) store the most recent 10 trips that have occurred where *Trip 0* (10.020) is the most recent and *Trip 9* (10.029) is the oldest. When a new trip occurs it is written to *Trip 0* (10.020) and all the other trips move down the log, with oldest being lost. The date and time when each trip occurs are also stored in the date and time log, i.e. *Trip 0 Date* (10.041) to *Trip 9 Time* (10.060). The date and time are taken from *Date* (06.016) and *Time* (06.017). Some trips have sub-trip numbers which give more detail about the reason for the trip. If a trip has a sub-trip number its value is stored in the sub-trip log, i.e. *Trip 0 Sub-trip Number* (10.070) to *Trip 9 Sub-trip Number* (10.079). If the trip does not have a sub-trip number then zero is stored in the sub-trip log.

If any parameter between Pr **10.020** and Pr **10.029** inclusive is read by serial communication, then the trip number in Table 13-2 is the value transmitted.

NOTE

The trip logs can be reset by writing a value of 255 in Pr **10.038**.

13.9 Behaviour of the drive when tripped

If the drive trips, the output of the drive is disabled so the load coasts to a stop. If any trip occurs, the following read only parameters are frozen until the trip is cleared. This is to help diagnose the cause of the trip.

Parameter	Description
01.001	Frequency reference
01.002	Pre-skip filter reference
01.003	Pre-ramp reference
02.001	Post-ramp reference
03.001	Final demand ref
03.002	Estimated frequency
03.003	Frequency error
03.004	Frequency controller output
04.001	Current magnitude
04.002	Active current
04.017	Reactive current
05.001	Output frequency
05.002	Output voltage
05.003	Power
05.005	DC bus voltage
07.001	Analog input 1
07.002	Analog input 2
07.037	Temperature nearest to trip level

If the parameters are not required to be frozen then this can be disabled by setting bit 4 of Pr **10.037**.

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Rev. 4.21