

# WTDR

## *Drive for pool industry*

USER MANUAL



**Flexible, simple, economical**



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VERSION : May, 2019



# Installation

## Notes for Fuse and Cable Table:

- (1) Installations with high fault current due to large supply mains may require a type D circuit breaker.
- (2) UL Class CC or T fast-acting current-limiting type fuses, 200,000 AIC, preferred. Bussman KTK-R, JJJ or JJS or equivalent.
- (3) Thermomagnetic type breakers preferred.

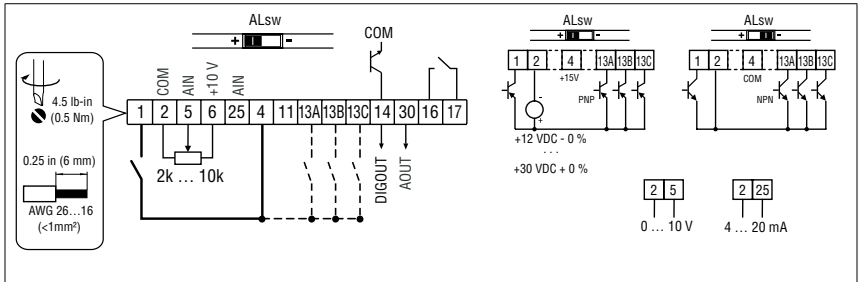
- ~ 11th digit of part number: F = Integral EMC Filter  
L = Integral EMC Filter and Integrated Disconnect Switch (NEMA 4X/IP65 Models only)  
M = Integrated Disconnect Switch (NEMA 4X/IP65 Models only)  
X = No EMC Filter/ No Disconnect Switch  
C = N4X Indoor only (convection cooled)  
E = N4X Indoor/Outdoor (convection cooled)  
D = N4X Indoor only (fan cooled)  
F = N4X Indoor/Outdoor (fan cooled)
- \* = Last digit of part number:  
~ = Last digit of part number:

Observe the following when using Ground Fault Circuit Interrupters (GFCIs):

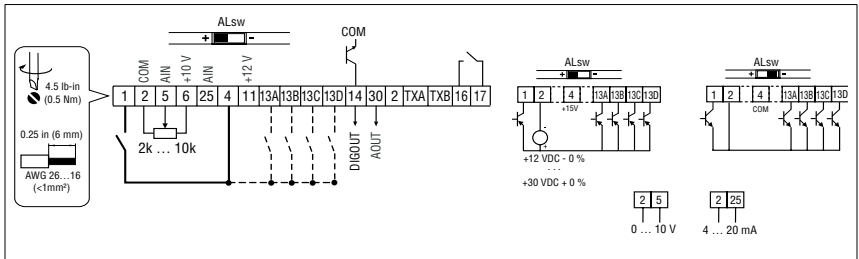
- Installation of GFCI only between supplying mains and controller.
- The GFCI can be activated by:
  - capacitive leakage currents between the cable screens during operation (especially with long, screened motor cables)
  - connecting several controllers to the mains at the same time
  - RFI filters

## 3.2.3 Control Terminals

### Control Terminal Strip for 0.33 - 10 HP (0.25 - 7.5 kW):



### Control Terminal Strip for 15HP (11 kW) and Greater Drives:



## NOTE

Control and communications terminals provide basic insulation when the drive is connected to a power system rated up to 300V between phase to ground (PE) and the applied voltage on terminals 16 and 17 is less than 250 VAC between phase to phase and ground (PE).



## Control Terminal Strip Descriptions

Terminal	Description	Important
1	Digital Input: Start/Stop	input resistance = 4.3k $\Omega$
2	Analog Common	
5	Analog Input: 0...10 VDC	input resistance: >50 k $\Omega$
6	Internal DC supply for speed pot	+10 VDC, max. 10 mA
25	Analog Input: 4...20 mA	input resistance: 250 $\Omega$
4	Digital Reference/Common	+15 VDC / 0 VDC, depending on assertion level
11	Internal DC supply for external devices	+12 VDC, max. 50 mA
13A	Digital Input: Configurable with P121	input resistance = 4.3k $\Omega$
13B	Digital Input: Configurable with P122	
13C	Digital Input: Configurable with P123	
13D*	Digital Input: Configurable with P124	
14	Digital Output: Configurable with P142, P144	DC 24 V / 50 mA; NPN
30	Analog Output: Configurable with P150...P155	0...10 VDC, max. 20 mA
2*	Analog Common	
TXA*	RS485 TxA	
TXB*	RS485 TxB	
16	Relay output: Configurable with P140, P144	AC 250 V / 3 A
17		DC 24 V / 2 A ... 240 V / 0.22 A, non-inductive

\* = Terminal is part of the terminal strip for the 15HP (11kW) and higher models only.

### Assertion level of digital inputs

The digital inputs can be configured for active-high or active-low by setting the Assertion Level Switch (ALsw) and P120. If wiring to the drive inputs with dry contacts or with PNP solid state switches, set the switch and P120 to "High" (+). If using NPN devices for inputs, set both to "Low" (-). Active-high (+) is the default setting.

HIGH = +12 ... +30 V

LOW = 0 ... +3 V



### NOTE

An **F<sub>RL</sub>** fault will occur if the Assertion Level switch (ALsw) position does not match the parameter P120 setting and P100 or any of the digital inputs (P121...P124) is set to a value other than 0.



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### 4.1 Local Keypad & Display

Models: 0.33-10HP (0.25-7.5kW)	Models: 15HP (11kW) and greater
4-Character Display	4-Character plus CTRL Display

Display	START BUTTON
	In Local Mode (P100 = 0, 4, 6), this button will start the drive.
	<b>STOP BUTTON</b> Stops the drive, regardless of which mode the drive is in. <b>WARNING!</b> When JOG is active, the STOP button will not stop the drive!
	<b>ROTATION</b> In Local Mode (P100 = 0, 4, 6), this selects the motor rotation direction: <ul style="list-style-type: none"> <li>- The LED for the present rotation direction (FWD or REV) will be on</li> <li>- Press R/F; the LED for the opposite rotation direction will blink</li> <li>- Press M within 4 seconds to confirm the change</li> <li>- The blinking direction LED will turn on, and the other LED will turn off</li> </ul> When rotation direction is changed while the drive is running, the commanded direction LED will blink until the drive is controlling the motor in the selected direction. Rotation is set in P112. When P112 = 0, rotation is forward only. When P112 = 1 rotation is forward and reverse.
	<b>MODE</b> Used to enter/exit the Parameter Menu when programming the drive and to enter a changed parameter value.
  	<b>UP AND DOWN BUTTONS</b>  Used for programming and can also be used as a reference for speed, PID setpoint, or torque setpoint. When the ▲ and ▼ buttons are the active reference, the middle LED on the left side of the display will be on.



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Display	START CONTROL
	The REMOTE/LOCAL LEDs indicate the current start control source. If the start control source is a remote keypad or the network, then both LEDs will be OFF.
	<b>REFERENCE CONTROL</b>
	The AUTO/MANUAL LEDs indicate the current reference control source.
	IF P113 = 0 or 2, the AUTO/MANUAL LEDs will match the AUTO LED on the 4-character display. IF P113 = 0 and no AUTO reference has been setup on the terminal strip, the MANUAL LED will turn ON and the AUTO LED will turn OFF.
	IF P113 = 1, the AUTO/MANUAL LEDs show the commanded reference control source as selected by the [CTRL] button. If the [CTRL] button is used to set the reference control source to AUTO but no AUTO reference has been setup on the terminal strip, reference control will follow P101 but the AUTO LED will remain ON.
	<b>UNITS LEDs</b>
	HZ: current display value is in Hz
	%: current display value is in %
	RPM: current display value is in RPM
	AMPS: current display value is in Amps
	/UNITS current display value is a per unit (i.e./sec, /min, /hr, etc.)
	In Speed mode, if P178 = 0 then HZ LED will be ON. If P178 > 0, the Units LEDs follow the setting of P177 when the drive is in run (non-programming) mode.
	In Torque mode, the HZ LED will be ON when the drive is in run (non-programming) mode.
	In Pid mode, the Units LEDs follow the setting of P203 when the drive is in run (non-programming) mode.
	If P179 > 0, the Units LEDs will show the unit of the diagnostic parameter that is being displayed.

## 4.2 Drive Display and Modes of Operation

### Speed Mode Display

In the standard mode of operation, the drive frequency output is set directly by the selected reference (keypad, analog reference, etc.). In this mode, the drive display will show the drive's output frequency.

### PID Mode Display

When the PID mode is enabled and active, the normal run display shows the actual PID setpoint. When PID mode is not active, the display returns to showing the drive's output frequency.

### Torque Mode Display

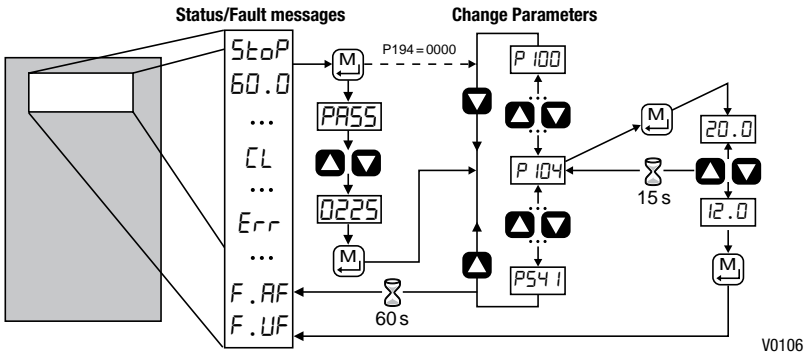
When the drive is operating in Vector Torque mode, the normal run display shows the drive's output frequency.

### Alternate (Run-Screen) Display

When P179 (Run Screen Display) is set to a value other than 0, one of the diagnostic parameters (P501...P599) is displayed. Example: if P179 is set to 1, then diagnostic parameter P501 (Software version) is displayed. If P179 =2, then P502 (Drive ID) is displayed.



## 4.3 Parameter Setting

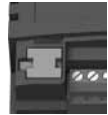


## 4.4 Electronic Programming Module

The MEM contains the drives operational memory. Parameter settings are stored in the MEM and setting changes are made to the “User settings” in the MEM.

An optional MEM Programmer (model MEM1R) is available that allows:

- An MEM to be copied directly to another MEM.
- An MEM to be copied to the memory of the MEM Programmer.
- Stored files can be modified in the MEM Programmer.
- Stored files can be copied to another MEM.



MEM Module  
in Drive

As the MEM Programmer is battery operated, parameter settings can be copied to an MEM and inserted into a drive without power being applied to the drive. This means that the drive will be fully operational with the new settings on the next application of power.

Additionally, when the drives parameter settings are burned into an MEM with the MEM Programmer, the settings are saved in two distinct locations; the “User settings” and the “OEM default settings”. While the User settings can be modified in the drive, the OEM settings cannot. Thus, the drive can be reset not only to the “factory” drive default settings (shown in this manual), but can be set to the Original Machine settings as programmed by the OEM.

The user area contents of the MEM are what are copied into the OEM space by the MEM programmer. When parameter modifications are made to the drive and then a copy made via the MEM Programmer, these are the settings that will be available by the OEM selections from P199. The MEM Programmer is the only way to load the OEM area of the MEM. While the MEM can be removed for copying or to use in another drive, it must be installed for the drive to operate (a missing MEM will trigger an  $F\_F 1$  fault)



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## 4.5 Parameter Menu

### 4.5.1 Basic Setup Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 100	Start Control Source	0	0 Local Keypad	Use RUN button on front of drive to start
			1 Terminal Strip	Use start/stop circuit wired into the terminal strip. Refer to section 3.2.3
			2 Remote Keypad Only	Use RUN button on optional Remote Keypad to start
			3 Network Only	
			4 Terminal Strip or Local Keypad	Allows start control to be switched between terminal strip and local keypad using one of the TB-13 inputs. See note below.
			5 Terminal Strip or Remote Keypad	Allows start control to be switched between terminal strip and optional remote keypad using one of the TB-13 inputs. See Note below
			6 CTRL button select	Allows start control to be switched between terminal strip and local keypad using the CTRL button. <b>NOTE:</b> P100 Selection 6 is applicable to 15HP (11kW) and higher models only.
	<b>WARNING!</b> P100 = 0 disables TB-1 as a STOP input! STOP circuitry may be disabled if parameters are reset back to defaults (see P199)			
	<b>NOTE</b>	<ul style="list-style-type: none"> <li>P100 = 4, 5: To switch between control sources, one of the TB-13 inputs (P121...P124) must be set to 08 (Control Select); TB-13x OPEN (or not configured): Terminal strip control TB-13x CLOSED: Local (P100 = 4) or Remote (P100 = 5) keypad</li> <li>P100 = 0, 1, 4, 6: Network can take control if P121...P124 = 9 and the corresponding TB-13x input is CLOSED.</li> <li>The STOP button on the front of the drive is always active except in JOG mode.</li> <li>TB-1 is an active STOP input if P100 is set to a value other than 0.</li> <li>An <b>F<sub>RL</sub></b> fault will occur if the Assertion Level switch (ALsw) position does not match the P120 setting and P100 is set to a value other than 0.</li> </ul>		
P 101	Standard Reference Source	0	0 Keypad (Local or Remote)	Selects the default speed or torque reference when no Auto Reference is selected using the TB-13 inputs.
			1 0-10 VDC	
			2 4-20 mA	
			3 Preset #1 (P131)	
			4 Preset #2 (P132)	
			5 Preset #3 (P133)	
			6 Network	
			7 Preset Sequence Segment #1 (P710)	Selections 7, 8 & 9 are not valid for PID setpoint or torque reference.
			8 Preset Sequence Segment #2 (P715)	
9 Preset Sequence Segment #3 (P720)				

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Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P 102	Minimum Frequency	0.0	0.0	{Hz}	P103	<ul style="list-style-type: none"> <li>P102, P103 are active for all speed references</li> <li>When using an analog speed reference, also see P160, P161</li> </ul>
P 103	Maximum Frequency	60.0	7.5	{Hz}	500	
			<b>NOTE</b> <ul style="list-style-type: none"> <li>P103 cannot be set below Minimum Frequency (P102)</li> <li>To set P103 above 120 Hz:                             <ul style="list-style-type: none"> <li>Scroll up to 120 Hz; display shows <b>H.Fr</b> (flashing).</li> <li>Release <math>\nabla</math> button and wait one second.</li> <li>Press <math>\nabla</math> button again to continue increasing P103.</li> </ul> </li> </ul>			
	<b>WARNING!</b> Consult motor/machine manufacturer before operating above rated frequency. Overspeeding the motor/machine may cause damage to equipment and injury to personnel!					
P 104	Acceleration Time 1	20.0	0.0	{s}	3600	<ul style="list-style-type: none"> <li>P104 = time of frequency change from 0 Hz to P167 (base frequency)</li> <li>P105 = time of frequency change from P167 to 0 Hz</li> <li>For S-ramp accel/decel, adjust P106</li> </ul>
P 105	Deceleration Time 1	20.0	0.0	{s}	3600	
	<b>EXAMPLE:</b> IF P103 = 120 Hz, P104 = 20.0 s and P167 (base frequency) = 60 Hz; then the rate of frequency change from 0 Hz to 120 Hz = 40.0 s					
P 106	S-Ramp Integration Time	0.0	0.0	{s}	50.0	<ul style="list-style-type: none"> <li>P106 = 0.0: Linear accel/decel ramp</li> <li>P106 &gt; 0.0: Adjusts S-ramp curve for smoother ramp</li> </ul>
P 107 <sup>(1)</sup>	Line Voltage Selection	1*	0	Low (120, 200, 400, 480VAC)		* The default setting is 1 for all drives except when using "Reset to 50Hz default settings" (Parameter P199, selection 4) with 480V models. In this case, the default setting is 0.
			1	High (120, 240, 480, 600VAC)		
P 108	Motor Overload	100	30	{%}	100	P108 = $\frac{\text{motor current rating} \times 100}{\text{Drive output rating}}$ Example: if motor = 3amps and Drive = 4amps, then P108 = 75%
			<b>NOTE</b> Do not set above rated motor current as listed on the motor dataplate. The motor thermal overload function of the unit is UL approved as a motor protection device. Cycling power after an overload fault could result in significantly reducing the motor life.			
P 109	Motor Overload Type	0	0	Speed Compensation		
			1	No Speed Compensation Example: Motor is cooled by forced ventilation as apposed to shaft mounted, self cooling fans.		

(1) Any changes to this parameter will not take effect until the drive is stopped.






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Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P110	Start Method	0	0 Normal	<p>Drive will automatically start when power is applied.</p> <p>When start command is applied, drive will apply DC braking according to P174, P175 prior to starting the motor</p> <p>Drive will automatically restart after faults, or when power is applied.</p> <p>Combines settings 2 and 3</p> <ul style="list-style-type: none"> <li>• Drive will automatically restart after faults, or when power is applied.</li> <li>• After 3 failed attempts, drive will Auto Restart with DC brake.</li> <li>• P110 = 5, 7: Performs speed search, starting at Max Frequency (P103)</li> <li>• P110 = 6, 8: Performs speed search, starting at the last output frequency prior to faulting or power loss</li> <li>• If P111 = 0, a flying START is performed when a start command is applied.</li> <li>• P110 = 7,8: Utilizes P280/281 to set Max Current Level and Decel Time for restart</li> </ul>
			1 Start on Power-up	
			2 Start with DC Brake	
			3 Auto Restart	
			4 Auto Restart with DC Brake	
			5 Flying Start/Restart - Type 1	
			6 Flying Start/Restart - Type 1	
			7 Flying Start /Restart - Type 2 for 2-pole motors requiring a flying restart	
			8 Flying Start/Restart - Type 2 for 2-pole motors requiring a flying restart	
			<p> <b>NOTE</b></p> <ul style="list-style-type: none"> <li>• P110 = 0, 2: Start command must be applied at least 2 seconds after power-up; <b>F<sub>U</sub>IF</b> fault will occur if start command is applied too soon.</li> <li>• P110 = 1, 3...6: For automatic start/restart, the start source must be the terminal strip and the start command must be present.</li> <li>• P110 = 2, 4...6: If P175=999.9, dc braking will be applied for 15s.</li> <li>• P110 = 3...6: Drive will attempt 5 restarts; if all restart attempts fail, drive displays <b>LC</b> (fault lockout) and requires manual reset.</li> <li>• P110 = 5, 6: If drive cannot catch the spinning motor, drive will trip into <b>F<sub>r</sub>RF</b> fault.</li> <li>• P110 = 5, 6: If drive trips into <b>F<sub>r</sub>DF</b> fault, try P110 = 7 or 8.</li> </ul>	
<p> <b>WARNING!</b> Automatic starting/restarting may cause damage to equipment and/or injury to personnel! Automatic starting/restarting should only be used on equipment that is inaccessible to personnel.</p>				
P111	Stop Method	0	0 Coast	Drive's output will shut off immediately upon a stop command, allowing the motor to coast to a stop
			1 Coast with DC Brake	The drive's output will shut off and then the DC Brake will activate (refer to P174, P175)
			2 Ramp	The drive will ramp the motor to a stop according to P105 or P126.
			3 Ramp with DC Brake	The drive will ramp the motor to 0 Hz and then the DC Brake will activate (refer to P174, P175)
P112	Rotation	0	0 Forward Only	If PID mode is enabled, reverse direction is disabled (except for Jog).
			1 Forward and Reverse	

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Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P113	Auto/Manual Control	0	0 Terminal Strip Control	The reference is dictated by the settings and state of the TB-13x terminals. If no AUTO reference has been setup on the terminal strip then reference control is dictated by P101.
			1 Auto/Manual (CTRL button select)	Allows the reference to be switched between auto and manual using the CTRL pushbutton on the drive keypad. If the CTRL pushbutton has selected AUTO reference but no AUTO reference has been setup on the terminal strip, then reference control is dictated by P101.
			2 Manual Control Only	Reference is dictated by P101 regardless of any AUTO source that may be selected by the TB-13x terminals.
			<b>NOTE</b> P113 is applicable to 15HP (11kW) and higher models only.	
P115	MOP Speed Initialization at Power-Up	0	0 Set to last MOP speed at power up	Output frequency at power-up = last MOP speed
			1 Set to 0.0Hz at power up	Output frequency at power-up = 0Hz
			2 Set to Preset #3 (P133) at power up	Output frequency at power-up = P133



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## 4.5.2 I/O Setup Parameters

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 120	Assertion Level	2	1 Low	P120 and the Assertion Level switch must both match the desired assertion level unless P100, P121...P124 are all set to 0. Otherwise an F.A.L fault will occur.
			2 High	
P 121	TB-13A Digital Input	0	0 None	Disables input
P 122	TB-13B Digital Input (Priority > TB13A) Same as TB13A except: 3 = Preset #2 23 = Seq Seg, #2		1 AUTO Reference: 0-10 VDC	For frequency mode, see P160...P161, For PID mode, see P204...P205, For vector torque mode, see P330
			2 AUTO Reference: 4-20 mA	For frequency mode see P131...P137, For PID mode, see P231...P233, For torque mode see, P331...P333
P 123	TB-13C Digital Input (Priority > TB13B, A) Same as TB13A except: 3 = Preset #3 23 = Seq Seg, #4		3 AUTO Reference: Preset #1	• Normally open: Close input to increase or decrease speed, PID or torque setpoint. • MOP Up is not active while in STOP
			* 13D: 3 = Reserved	
P 124	TB-13D* Digital Input (Priority > TB13C, B, A) Same as TB13A except: 3 = Preset #4 23 = Seq Seg, #8		4 AUTO Reference: MOP Up	
			5 AUTO Reference: MOP Down	
 <p><b>NOTE: P124</b> is applicable to 15HP (11kW) and higher models only</p>			6 AUTO Reference: Keypad	
			7 AUTO Reference: Network	
			8 Control Select	Use when P100 = 4, 5 to switch between terminal strip control and local or remote keypad control. Required to start the drive through the network. Open = Forward Closed = Reverse
			9 Network Enable	
			10 Reverse Rotation	
			11 Start Forward	
			12 Start Reverse	Refer to Note for typical circuit
			13 Run Forward	Refer to Note for typical circuit
			14 Run Reverse	
			15 Jog Forward	Jog Forward speed = P134
			16 Jog Reverse	Jog Reverse speed = P135  Active even if P112 = 0
			17 Accel/Decel #2	Refer to P125, P126
			18 DC Brake	Refer to P174; close input to override P175
			19 Auxiliary Ramp to Stop	Normally closed: Opening input will ramp drive to STOP according to P127, even if P111 is set to Coast (0 or 1). Close to reset fault
20 Clear Fault				
21 External Fault <b>F_EF</b>	Normally closed circuit; open to trip			
22 Inverse External Fault <b>F_EF</b>	Normally open circuit; close to trip			
23 AUTO Ref: Sequence Segment #1	Works in Speed Mode only			
24 Start Sequence				
25 Step Sequence	Transition from non-asserted to asserted state			
26 Suspend Sequence				
	<b>WARNING</b> Jog overrides all STOP commands! To stop the drive while in Jog mode, the Jog input must be deactivated or a fault condition induced.			
	<b>WARNING</b> If the input defined to "Start Sequence" is opened during a sequence, the drive will exit sequencer mode and will run at the specified standard or alternate speed source (dependent on drive configuration).			

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Code		Possible Settings				IMPORTANT																																																								
No.	Name	Default	Selection																																																											
<p><b>NOTE</b></p> <ul style="list-style-type: none"> <li>When input is activated, settings 1...7 override P101</li> <li>When TB-13A...TB-13D are configured for Auto References other than MOP, TB-13D overrides TB-13C, TB-13C overrides TB-13B and TB-13B overrides TB-13A. Any other Auto Reference will have priority over MOP.</li> <li>Settings 10...14 are only valid in Terminal Strip mode (P100 = 1, 4, 5, 6)</li> <li>If Start/Run/Jog Forward and Start/Run/Jog Reverse are both activated, drive will STOP</li> <li>If Jog input is activated while drive is running, the drive will enter Jog mode; when Jog input is deactivated, drive will STOP</li> <li>An <b>F..RL</b> fault will occur if the Assertion Level switch (ALsw) position does not match the P120 setting and any of the digital inputs (P121...P124) are set to a value other than 0.</li> <li>An <b>F..I L</b> fault will occur under the following conditions:                     <ul style="list-style-type: none"> <li>TB-13A...TB-13D settings are duplicated (each setting, except 0, 3 and 23, can only be used once)</li> <li>One input is set to "MOP Up" and another is not set to "MOP Down", or vice-versa.</li> <li>One input is set to 10 and another input is set to 11...14.</li> <li>One input is set to 11 or 12 and another input is set for 13 or 14.</li> </ul> </li> <li>Typical control circuits are shown below:                     <ul style="list-style-type: none"> <li>If any input is set to 10, 12 or 14, P112 must be set to 1 for Reverse action to function.</li> </ul> </li> </ul> <div style="display: flex; justify-content: space-around; align-items: flex-start;"> <div style="text-align: center;"> <p>Run / Stop with Direction P121 = 10</p> </div> <div style="text-align: center;"> <p>Start Forward / Start Reverse P121 = 11, P122 = 12</p> </div> <div style="text-align: center;"> <p>Run Forward / Run Reverse P121 = 13, P122 = 14</p> </div> </div>	<b>P 125</b>	Acceleration Time 2	20.0	0.0	{s}	3600	<ul style="list-style-type: none"> <li>Selected using TB-13A...TB-13D (P121...P124 = 17)</li> <li>For S-ramp accel/decel, adjust P106</li> </ul>																																																							
	<b>P 126</b>	Deceleration Time 2	20.0	0.0	{s}	3600																																																								
	<b>P 127</b>	Deceleration Time for Auxiliary Ramp to Stop	20.0	0.0	{s}	3600	<ul style="list-style-type: none"> <li>Selected using TB-13A...TB-13D (P121...P124 = 19).</li> <li>For S-ramp accel/decel, adjust P106</li> <li>Once executed, this ramp time has priority over P105 and P126.</li> </ul>																																																							
	<b>P 129</b>	Automatic Accel/Decel rate switch threshold	0.0	0.0	{Hz}	1000	If Actual Frequency < P129 Use Accel/decel time #2 (P125/P126) If Actual Frequency > P129 Use Accel/decel time #1 (P104/P105)																																																							
	<b>P 131</b>	Preset Speed #1	0.0	0.0	{Hz}	500	<table border="1"> <thead> <tr> <th>PRESET SPEED</th> <th>13A</th> <th>13B</th> <th>13C</th> <th>13D</th> </tr> </thead> <tbody> <tr><td>1</td><td>X</td><td>--</td><td>--</td><td>--</td></tr> <tr><td>2</td><td>--</td><td>X</td><td>--</td><td>--</td></tr> <tr><td>3</td><td>--</td><td>--</td><td>X</td><td>--</td></tr> <tr><td>4</td><td>X</td><td>X</td><td>--</td><td>--</td></tr> <tr><td>4 (alternate)</td><td>--</td><td>--</td><td>--</td><td>X</td></tr> <tr><td>5</td><td>X</td><td>--</td><td>X</td><td>--</td></tr> <tr><td>6</td><td>--</td><td>X</td><td>X</td><td>--</td></tr> <tr><td>7</td><td>X</td><td>X</td><td>X</td><td>--</td></tr> <tr><td>8 (alternate)</td><td>--</td><td>X</td><td>--</td><td>X</td></tr> <tr><td>8 (alternate)</td><td>--</td><td>--</td><td>X</td><td>X</td></tr> </tbody> </table>	PRESET SPEED	13A	13B	13C	13D	1	X	--	--	--	2	--	X	--	--	3	--	--	X	--	4	X	X	--	--	4 (alternate)	--	--	--	X	5	X	--	X	--	6	--	X	X	--	7	X	X	X	--	8 (alternate)	--	X	--	X	8 (alternate)	--	--	X	X
	PRESET SPEED	13A	13B	13C	13D																																																									
	1	X	--	--	--																																																									
	2	--	X	--	--																																																									
	3	--	--	X	--																																																									
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5	X	--	X	--																																																										
6	--	X	X	--																																																										
7	X	X	X	--																																																										
8 (alternate)	--	X	--	X																																																										
8 (alternate)	--	--	X	X																																																										
<b>P 132</b>	Preset Speed #2	0.0	0.0	{Hz}	500																																																									
<b>P 133</b>	Preset Speed #3	0.0	0.0	{Hz}	500																																																									
<b>P 134</b>	Preset Speed #4	0.0	0.0	{Hz}	500																																																									
<b>P 135</b>	Preset Speed #5	0.0	0.0	{Hz}	500																																																									
<b>P 136</b>	Preset Speed #6	0.0	0.0	{Hz}	500																																																									
<b>P 137</b>	Preset Speed #7	0.0	0.0	{Hz}	500																																																									
<b>P 138</b>	Preset Speed #8	0.0	0.0	{Hz}	500																																																									
						<ul style="list-style-type: none"> <li>Speed setting is used by P158</li> <li>13D available on 15HP (11kW) &amp; higher drives.</li> </ul>																																																								



## Commissioning

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
<b>P 140</b>	Relay Output TB-16, 17	0	0 None	Disables the output
			1 Run	Energizes when the drive is running
			2 Reverse	Energizes when reverse rotation is active
			3 Fault	De-energizes when the drive trips, or power is removed
			4 Inverse Fault	Energizes when the drive trips
			5 Fault Lockout	P110 = 3...6: De-energizes if all restart attempts fail
			6 At Speed	Energizes when output frequency = commanded frequency
			7 Above Preset Speed #6	Energizes when output frequency > P136
			8 Current Limit	Energizes when motor current = P171
			9 Follower Loss (4-20 mA)	Energizes when 4-20 mA signal is < P164
			10 Loss of Load	Energizes when motor load drops below P145; Refer to P146 also
			11 Local Keypad Control Active	
			12 Terminal Strip Control Active	Energizes when the selected source is active for start control
			13 Remote Keypad Control Active	
			14 Network Control Active	
			15 Standard Reference Active	Energizes when P101 reference is active
			16 Auto Reference Active	Energizes when Auto Reference is activated using TB-13 input; refer to P121...P124
			17 Sleep Mode Active	Refer to P240...P242
			18 PID Feedback < Min. Alarm	Energizes when PID feedback signal < P214
			19 Inverse PID Feedback < Min. Alarm	De-energizes when PID feedback signal < P214
			20 PID Feedback > Max Alarm	Energizes when PID feedback signal > P215
			21 Inverse PID Feedback > Max Alarm	De-energizes when PID feedback signal > P215
			22 PID Feedback within Min/Max Alarm range	Energizes when PID feedback signal is within the Min/Max Alarm range; refer to P214, P215
			23 PID Feedback outside Min/Max Alarm range	Energizes when PID feedback signal is outside the Min/Max Alarm range; refer to P214, P215
			24 Reserved	
			25 Network Controlled	Models < 15HP (11kW) require an optional communication module (refer to the network module documentation).
			26 Loss of 0-10V Input	Energizes when 0-10V signal is < P158
			27 Sequencer Controlled	State set in individual sequencer segments
			28 Sequencer Active	
			29 Sequencer Suspended	
			30 Sequence Done	End Sequence
31 Output Frequency = 0.0Hz	Output inactive			
<b>P 142</b>	TB-14 Output	0	0...23 (same as P140)	
			24 Dynamic Braking	For use with Dynamic Braking option
			25...31 (same as P140)	

# Commissioning



Code		Possible Settings				IMPORTANT																	
No.	Name	Default	Selection																				
P 144	Digital Output Inversion		<table border="1"> <tr> <td>P144</td> <td>Invert P142</td> <td>Invert P140</td> </tr> <tr> <td>0</td> <td>NO</td> <td>NO</td> </tr> <tr> <td>1</td> <td>NO</td> <td>YES</td> </tr> <tr> <td>2</td> <td>YES</td> <td>NO</td> </tr> <tr> <td>3</td> <td>YES</td> <td>YES</td> </tr> </table>			P144	Invert P142	Invert P140	0	NO	NO	1	NO	YES	2	YES	NO	3	YES	YES	Used to invert the selections for P140 (Relay Output) and P142 (TB-14 Output). EXAMPLE: When P140 = 6 (AT SPEED), the relay is energized when output frequency = commanded frequency. If P144=1 or 3, then P140 is inverted (INVERSE AT SPEED) and the relay is energized when the output frequency does <b>not</b> equal the command frequency.		
			P144	Invert P142	Invert P140																		
			0	NO	NO																		
1	NO	YES																					
2	YES	NO																					
3	YES	YES																					
	<b>NOTE</b> Inverting P140 or P142 when the parameter is set to NONE (0) will result in the output being energized continuously.																						
	<b>NOTE</b> For drives rated at 0.33 to 10 HP (0.25 to 7.5 kW), P144 is only available with software versions 3.0 and higher (refer to P501).																						
P 145	Loss of Load Threshold	0	0	{%}	200	P140, P142 = 10: Output will energize if motor load falls below the P145 value longer than the P146 time																	
P 146	Loss of Load Delay	0.0	0.0	{s}	240.0																		
P 149	Analog Output Offset	0.0	0	{%}	100	Scaled value. Example: P149 = 10%, Scaled variable = freq, P150 = 1, P152 = 60Hz; then TB30 = 0VDC below 6Hz																	
P 150	TB-30 Output	0	0 None			2-10 VDC signal can be converted to 4-20 mA with a total circuit impedance of 500 Ω																	
			1 0-10 VDC Output Frequency																				
			2 2-10 VDC Output Frequency																				
			3 0-10 VDC Load																				
			4 2-10 VDC Load																				
			5 0-10 VDC Torque																				
			6 2-10 VDC Torque																				
			7 0-10 VDC Power (kW)																				
			8 2-10 VDC Power (kW)																				
			9 Network Controlled																				
10 Sequencer Controlled			Models < 15HP (11kW) require an optional communication module (refer to the network module documentation). Value set in individual sequencer segments																				
P 152	TB-30 Scaling: Frequency	60.0	3.0	{Hz}	2000	If P150 = 1 or 2, sets the frequency at which output equals 10 VDC																	
P 153	TB-30 Scaling: Load	200	10	{%}	500	If P150 = 3 or 4, sets the Load (as a percent of drive current rating) at which output equals 10 VDC.																	
P 154	TB-30 Scaling: Torque	100	10	{%}	1000	If P150 = 5 or 6, sets the Torque (as a percent of motor rated torque) at which output equals 10 VDC																	
P 155	TB-30 Scaling: Power (kW)	1.0	0.1	{kW}	200.0	If P150 = 7 or 8, sets the power at which output equals 10 VDC																	



# Commissioning

## 4.5.3 Advanced Setup Parameters

Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P 156	Analog Inputs Configuration	0	0 TB5: (0-10 VDC); TB25: (4-20mA) 1 TB5: (0 - 5 VDC); TB25: (4-20mA) 2 TB5: (2 - 10 VDC); TB25: (4-20mA) 4 TB5: (0-10 VDC); TB25: (0-20mA) 5 TB5: (0 - 5 VDC); TB25: (0-20mA) 6 TB5: (2 - 10 VDC); TB25: (0-20mA)			
P 157	TB5 (0-10V) Analog Input Monitoring Action	0	0 No Action 1 If TB5 < P158 - Trip Fault $F\_FAU$ 2 If TB5 < P158 - Run Preset #8 3 If TB5 < P158 - Run Preset Seg. #16 4 If TB5 > P158 - Trip Fault $F\_FAU$ 5 If TB5 > P158 - Run Preset #8 6 If TB5 > P158 - Run Preset Seg. #16			Selects the reaction to a loss of the 0-10V signal at TB5  500ms is the minimum time above/below Monitoring Level (P158) before triggering the drive to trip or run at a preset speed.  For P157 = 3 or 6, the accel/decel time is set in P786. <b>NOTE:</b> P157 has priority over P163 and TB-13 presets/auto references (P121-P124)
P 158	TB5 (0-10V) Analog Input Monitoring Level (ML)	0.0	-10.0	{VDC}	10.0	Negative input voltage is not currently supported.
P 159	0-10V Analog Input Deadband	0.0	0	{VDC}	10.0	Not active if [-10 to +10 VDC] option is selected.
P 160	Speed at Minimum Signal	0.0	-999.0	{Hz}	1000	<p style="text-align: right;">V0111</p>
P 161	Speed at Maximum Signal	60.0	-999.0	{Hz}	1000	
			<b>NOTE</b> <ul style="list-style-type: none"> <li>• P160 sets the output frequency at 0% analog input</li> <li>• P161 sets the output frequency at 100% analog input</li> <li>• P160 or P161 &lt; 0.0 Hz: For scaling purposes only; does not indicate opposite direction!</li> <li>• P160 &gt; P161: Drive will react inversely to analog input signal</li> </ul>			
P 162	Analog Input Filter	0.01	0.00	{s}	10.00	<ul style="list-style-type: none"> <li>• Adjusts the filter on the analog inputs (TB-5 and TB-25) to reduce the effect of signal noise</li> <li>• The P162 delay time will affect the response time of diagnostic parameters (P520-P523).</li> </ul>
P 163	TB-25 (4-20mA) Analog Input Monitoring Action	0	0 No Action 1 If TB25 < P164 - Trip Fault $F\_FaL$ 2 If TB25 < P164 - Run Preset #7 3 If TB25 < P164 - Run Preset Seg. #15 4 If TB25 ≥ P164 - Trip Fault $F\_FaL$ 5 If TB25 ≥ P164 - Run Preset #7 6 If TB25 ≥ P164 - Run Preset Seg. #15			<ul style="list-style-type: none"> <li>• Selects the reaction to a loss of the 4-20 mA signal at TB-25.</li> <li>• Signal is considered lost if it falls below the value set in P164</li> <li>• Digital outputs can also indicate a loss of 4-20 mA signal; see P140, P142</li> <li>• For P163 = 3 or 6, the accel/decel time is set in P781.</li> </ul> <b>NOTE:</b> P163 has priority over TB-13 presets/auto references (P121-P124)

# Commissioning



Code		Possible Settings				IMPORTANT
No.	Name	Default	Selection			
P 164	TB-25 (4-20mA) Analog Input Monitoring Level	2.0	0.0	{mA}	20.0	
P 165	Base Voltage		15	{V}	1000	Valid for V/Hz mode only. Set voltage for bus compensation in V/Hz mode
P 166	Carrier Frequency	See Notes	0 1 2 3	4 kHz 6 kHz 8 kHz 10 kHz		<ul style="list-style-type: none"> <li>As carrier frequency is increased, motor noise is decreased</li> <li>Observe derating in section 2.3</li> <li>Automatic shift to 4 kHz at 120% load</li> <li>NEMA 4X (IP65) Models: Default = 0 (4kHz)</li> <li>NEMA 1 (IP31) Models: Default = 1 (6kHz)</li> </ul>
P 167 <sup>(1)</sup>	Base Frequency	60.0	10.0	{Hz}	1500	<p>V0112</p>
P 168	Fixed Boost		0.0	{%}	40.0	
		<b>i</b>	<b>NOTE</b> <ul style="list-style-type: none"> <li>P167 = rated motor frequency for standard applications</li> <li>P165, P168 = default setting depends on drive rating</li> </ul>			
P 169	Accel Boost	0.0	0.0	{%}	20.0	Accel Boost is only active during acceleration
P 170	Slip Compensation	0.0	0.0	{%}	40.0	Increase P170 until the motor speed no longer changes between no load and full load conditions.
P 171 <sup>(1)</sup>	Current Limit	Max I	30	{%}	Max I	<ul style="list-style-type: none"> <li>When the limit is reached, the drive displays <b>CL</b> (Current Limit), and either the acceleration time increases or the output frequency decreases.</li> <li>Digital outputs can also indicate when the limit is reached; see P140, P142.</li> <li>Refer to section 2.3 for the maximum output current Max I (%)</li> </ul>
P 172	Current Limit Reduction	0	0 1 2 3	Current Limit Reduction Active - Normal response Current Limit Reduction Active - Fast response Current Limit Reduction Disabled - Normal response Current Limit Reduction Disabled - Fast response		In field weakening, the Current Limit is inversely proportional to the speed.
P 173	Decel Override Time	2.0	0.0	{s}	60.0	Maximum time before drive trips into HF fault.
P 174	DC Brake Voltage	0.0	0.0	{%}	50.0	Setting is a percent of the nominal DC bus voltage.

(1) Any changes to this parameter will not take effect until the drive is stopped.





# Commissioning

Code		Possible Settings			IMPORTANT			
No.	Name	Default	Selection					
P 175	DC Brake Time	0.0	0.0	{s}	999.9	<p><b>NOTE:</b> CONFIRM MOTOR SUITABILITY FOR USE WITH DC BRAKING</p> <p>DC Brake voltage (P174) is applied for the time specified by P175 with the following exceptions:</p> <ul style="list-style-type: none"> <li>If P111=1, 3 and P175=999.9 the brake voltage will be applied continuously until a run or fault condition occurs.</li> <li>If P110=2, 4...6 and P175=999.9, brake voltage will be applied for 15s</li> <li>If P121...P124=18 and the corresponding TB-13 input is CLOSED, brake voltage will be applied until the TB-13 input is OPENED or a fault condition occurs.</li> </ul>		
P 176	Keypad Setpoint Single Press Increment	0.1	0.1		100.0	Used for run screen setpoint editing only. If P176 >0.1 then scrolling of keypad setpoint is disabled.		
P 177	Speed Units	0	0 Hz	1 RPM	2 %	3 /UNITS	4 NONE	Select the UNITS LED that will be illuminated when the drive is running in speed control mode. For this parameter to be used, P178 must be set to a value other than 0. If P178 is set to 0, the Hz LED will be illuminated regardless of the value set in P177.
P 178	Display Frequency Multiplier	0.00	0.00		650.00	<ul style="list-style-type: none"> <li>Allows frequency display to be scaled</li> <li>P178 = 0.00: Scaling disabled</li> <li>P178 &gt; 0.00: Display = Actual Frequency X P178</li> </ul>		
			<p>EXAMPLE</p> <p>If P178 = 29.17 and actual frequency = 60 Hz, then Drive displays 1750 (rpm)</p>					
P 179	Run Screen Display	0	0	{Parameter Number}	599	<ul style="list-style-type: none"> <li>0 = Normal Run Screen, this display depends on mode of operation. Refer to section 4.2.</li> <li>Other selections choose a diagnostic parameter to display (P501...P599).</li> <li>Parameters P560 - P564 are selectable if the sequencer is enabled (P700 is not 0). P560-P564 are not visible until P700 is enabled.</li> </ul>		
P 180	Oscillation Damping Control	0	0		80	0 = Damping disabled Compensation for resonances within drive		
P 181	Skip frequency 1	0.0	0.0	{Hz}	500	<ul style="list-style-type: none"> <li>Drive will not run in the defined skip range; used to skip over frequencies that cause mechanical vibration</li> <li>P181 and P182 define the start of the skip ranges</li> <li>P184 &gt; 0 defines the bandwidth of both ranges.</li> </ul>		
P 182	Skip frequency 2	0.0	0.0	{Hz}	500			
P 184	Skip frequency bandwidth	0.0	0.0	{Hz}	10.0			
			<p><b>NOTE</b></p> <p>Bandwidth (Hz) = <math>f_s</math> (Hz) + P184 (Hz)      <math>f_s</math> = P181 or P182</p> <p>EXAMPLE: P181 = 18 Hz and P184 = 4 Hz; skip range is from 18 to 22 Hz</p>					
P 185	Voltage Midpoint V/Hz characteristic	0	0.0	{V}	P165	Valid only when P300 = 0 or 2. Use with P187 to define midpoint on V/Hz curve.		
P 187	Frequency Midpoint V/Hz characteristic	0.0	0.0	{Hz}	P167	Valid only when P300 = 0 or 2. Use with P185 to define midpoint on V/Hz curve.		
P 189	Integrated Dynamic Brake	0	Disabled					
		1	Enabled					

(2) Parameter applicable to models 15HP (11kW) and higher. (3)

Parameter applicable to models 40HP (30kW) and higher.


# Commissioning



Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 190	Motor Braking		0 Disabled	Flux brake OFF.
			1 Braking with BUS threshold	When drive is in deceleration and $V_{bus} > V_{dec \text{ or } a \text{ sin freq}}$ (114% of the rated $V_{bus}$ ), the flux brake will be turned ON.
			2 Braking always on with deceleration	As long as drive is in deceleration, the flux brake will be ON.
			3 Braking with bus regulator	When drive is in deceleration and $V_{bus} > V_{dec \text{ or } a \text{ sin freq}}$ (114% of the rated $V_{bus}$ ), the motor speed will be increased to reduce the bus voltage. Determined by the value in P191, the speed increment = slip speed * P191(%) / 37.
			4 Special	(Consult factory before using)
		<b>WARNING</b> Flux braking can cause heat in the motor. To avoid damage to the motor, use a PTC to protect the motor. If the flux brake is used too frequently, the drive will trip fault "F_PF".		
P 191	Motor Brake Level	0	0 { } 75 (flux braking disabled)	Active when P190 > 0 and drive is in deceleration mode. Use to reduce deceleration time on high inertia loads. <b>NOTE:</b> Over usage of P190 can cause frequent 'overload' trips "F.PF" Not active for P300 = 5 (Torque mode)
P 192	Motor Braking Deceleration Reduction Level	0.0	0 P167 (base freq)  Raising the value of P191 reduces the drive deceleration rate during flux braking.	Active when P190 > 0 and P192 > 0.0, Drive is in deceleration mode. Use to reduce deceleration time on high inertia loads. <b>NOTE:</b> Usage of P192 can cause the drive to decelerate faster than settings in P105/P127. Not active for P300 = 5 (Torque mode)
P 194	Password	0	0000 9999	<ul style="list-style-type: none"> <li>Must enter password to access parameters</li> <li>P194 = 0000: Disables password</li> </ul>
P 197	Clear Fault History	0	0 No Action 1 Clear Fault History	
P 199	Program Selection		0 Operate from User settings	
			1 Operate from OEM settings	Refer to Notes 1, 2 and 3
			2 Reset to OEM default settings	Refer to Note 1
			3 Reset to 60 Hz default settings	<ul style="list-style-type: none"> <li>Refer to Note 4</li> <li>Parameters are reset to the defaults listed in this manual.</li> <li>For P199=4, the following exceptions apply:                             <ul style="list-style-type: none"> <li>P103, P152, P161, P167 = 50.0 Hz</li> <li>P165 = 400V (400/480V drives only)</li> <li>P304 = 50 Hz</li> <li>P305 = 1450 RPM</li> <li>P107 = 0 (480 V drives only)</li> </ul> </li> </ul>
			4 Reset to 50 Hz default settings	
			5 Translate	Refer to Note 5
				<b>WARNING!</b> Modification of P199 can affect drive functionality! STOP and EXTERNAL FAULT circuitry may be disabled! Check P100 and P121...P124
	<b>NOTE 1</b> If the MEM does not contain valid OEM settings, a flashing CF will be displayed when P199 is set to 1 or 2. <b>NOTE 2</b> When P199 is set to 1, the drive operates from the OEM settings stored in the MEM Module and no other parameters can be changed (GE will be displayed if attempted). <b>NOTE 3</b> Auto Calibration is not possible when operating from OEM Settings. <b>NOTES 4 and 5 - on next page.</b>			



## Commissioning

Code		Possible Settings		IMPORTANT
No.	Name	Default	Selection	
P 199	Program Selection		<p><b>NOTE 4</b> Resetting to 50 and 60 Hz default settings will set the Assertion Level (P120) to "2" (High). P120 may need to be reset for the digital input devices being used. An <b>F..RL</b> fault may occur if P120 and the Assertion switch are not set identically.</p> <p><b>NOTE 5</b> If an MEM that contains data from a previous compatible software version is installed:</p> <ul style="list-style-type: none"><li>• The drive will operate according to the previous data, but parameters cannot be changed (<b>cE</b> will be displayed if attempted)</li><li>• To update the MEM to the current software version, set P199 = 5. The parameters can now be changed but the MEM is incompatible with previous software revisions.</li></ul>	



## 4.5.7 Diagnostic Parameters

Code		Display Range (READ ONLY)		IMPORTANT
No.	Name			
P500	Fault History			<ul style="list-style-type: none"> <li>Displays the last 8 faults</li> <li>Format: n.xxx where: n = 1..8, 1 is the newest fault; xxx = fault message (w/o the F.)</li> <li>Refer to section 5.3</li> </ul>
P501	Software Version			Format: x.yz
P502	Drive ID			A flashing display indicates that the Drive ID stored in MEM does not match the drive model it is plugged into.
P503	Internal Code			Alternating Display: xxx-; -yy
P505	DC Bus Voltage	0	{VDC} 1500	
P506	Motor Voltage	0	{VAC} 1000	
P507	Load	0	{%} 255	Motor load as % of drive's output current rating. Refer to section 2.3.
P508	Motor Current	0.0	{A} 1000	Actual motor current
P509	Torque	0	{%} 500	Torque as % of motor rated torque (vector mode only)
P510	Output Power kW	0.00	{kW} 650.0	
P511	Total kWh	0.0	{kWh} 9999999	Alternating display: xxx-; yyyy when value exceeds 9999
P512	Heatsink Temp	0	{°C} 150	Heatsink temperature
P520	0-10 VDC Input	0.0	{VDC} 10.0	Actual value of signal at TB-5 (See P162)
P521	4-20 mA Input	0.0	{mA} 20.0	Actual value of signal at TB-25 (See P162)
P522	TB-5 Feedback	P204	P205	TB-5 signal value scaled to PID feedback units (See P162)
P523	TB-25 Feedback	P204	P205	TB-25 signal value scaled to PID feedback units (See P162)
P524	Network Feedback	P204	P205	Network signal value scaled to PID feedback units
P525	Analog Output	0	{VDC} 10.0	Refer to P150...P155
P527	Actual Output Frequency	0	{Hz} 500.0	
P528	Network Speed Command	0	{Hz} 500.0	Command speed if (Auto: Network) is selected as the speed source
P530	Terminal and Protection Status			Indicates terminal status using segments of the LED display. (Refer to section 4.5.7.1)
P531	Keypad Status			Indicates keypad button status using segments of the LED display. (Refer to section 4.5.7.2)
P540	Total Run Time	0	{h} 9999999	Alternating display: xxx-; yyyy when value exceeds 9999
P541	Total Power On Time	0	{h} 9999999	
P550	Fault History	1	8	<ul style="list-style-type: none"> <li>Displays the last 8 faults</li> <li>Format: n.xxx where: n = 1..8, 1 is the newest fault; xxx = fault message (w/o the F.)</li> <li>Refer to section 5.3</li> </ul>
P551	Fault History Time	0	{h} 999999	Display: "n.hh-" "hhhh" "mm.ss" = fault #, hours, seconds The "hhhh" screen is displayed after hours exceed 999.
P552	Fault History Counter	0	255	Number of sequential occurrences of a fault. For example: 3 external faults occur over a period of time with no other errors occurring. Then P552 will indicate 3, P550 will indicate the error EF and P551 will indicate the time of the first fault occurrence.



# Commissioning

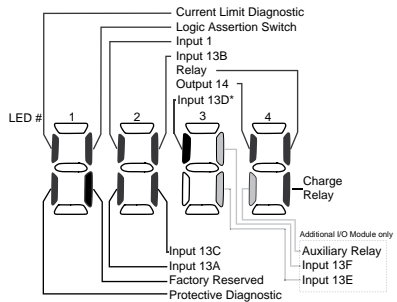
Code		Display Range (READ ONLY)		IMPORTANT
No.	Name			
P560	Sequencer: Currently Active Segment	0	17	
P561	Sequencer: Time since Start of Active Segment	0.0 0	{P708} {P708} 6553.5 65535	Unit depends on P708 (0.1sec, sec or minutes)
P562	Sequencer: Time Remaining in Active Segment	0.0 0	{P708} {P708} 6553.5 65535	Unit depends on P708 (0.1sec, sec or minutes)
P563	Sequencer: Number of cycles since start	0	65535	
P564	Sequencer: Number of cycles remaining	0	65535	
		<b>NOTE:</b> Parameters P560-P564 are visible only when P700 > 0 (i.e. the sequencer is enabled)		

## 4.5.7.1 Terminal & Protection Status Display

Parameter P530 allows monitoring of the control terminal points and common drive conditions:

An illuminated LED segment indicates:

- the protective circuit is active (LED 1)
- the Logic Assertion Switch is set to High (+)
- input terminal is asserted (LED 2)
- output terminal is energized (LED 4)
- the Charge Relay is not a terminal, this segment will be illuminated when the Charge Relay is energized (LED 4).



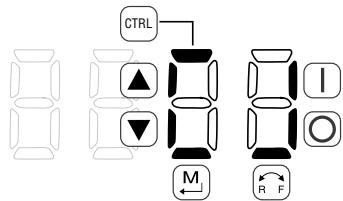
\* Input 13D available on 15-60HP (11-45kW) models only

## 4.5.7.2 Keypad Status Display

Parameter P531 allows monitoring of the keypad pushbuttons:

An illuminated LED segment indicates when the button is depressed.

LED 1 and LED 2 are used to indicate pushbutton presses on a remote keypad that is attached to the drive. LED 3 and LED 4 indicate button presses on the local drive keypad.





## 5 Troubleshooting and Diagnostics

### 5.1 Status/Warning Messages

Status / Warning	Cause	Remedy
<b>br</b> DC-injection brake active	DC-injection brake activated <ul style="list-style-type: none"> <li>activation of digital input (P121...P124 = 18)</li> <li>automatically (P110 = 2, 4...6)</li> <li>automatically (P111 = 1, 3)</li> </ul>	Deactivate DC-injection brake <ul style="list-style-type: none"> <li>deactivate digital input</li> <li>automatically after P175 time has expired</li> </ul>
<b>bF</b> Drive ID warning	The Drive ID (P502) stored on the MEM does not match the drive model.	<ul style="list-style-type: none"> <li>Verify motor data (P302...P306) and perform Auto Calibration.</li> <li>Set drive mode (P300) to 0 or 1</li> <li>Reset the drive (P199 to 3 or 4) and reprogram.</li> </ul>
<b>CAL</b> Motor Auto-calibration active	Refer to P300, P399	Motor Auto-calibration is being performed
<b>eE</b> An MEM that contains valid data from a previous software version has been installed	An attempt was made to change parameter settings	Parameter settings can only be changed after the MEM data is converted to the current version (P199 = 5)
<b>CL</b> Current Limit (P171) reached	Motor overload	<ul style="list-style-type: none"> <li>Increase P171</li> <li>Verify drive/motor are proper size for application</li> </ul>
<b>dEC</b> Decel Override	The drive has stopped decelerating to avoid tripping into <b>HF</b> fault, due to excessive motor regen (2 sec max).	If drive trips into <b>HF</b> fault: <ul style="list-style-type: none"> <li>Increase P105, P126</li> <li>Install Dynamic Braking option</li> </ul>
<b>Err</b> Error	Invalid data was entered, or an invalid command was attempted	
<b>FCL</b> Fast Current Limit	Overload	Verify drive/motor are proper size for application
<b>FSt</b> Flying Restart Attempt after Fault	P110 = 5,6	
<b>GE</b> OEM Settings Operation warning	An attempt was made to change parameter settings while the drive is operating in OEM Settings mode.	In OEM Settings mode (P199 = 1), making changes to parameters is not permitted.
<b>GF</b> OEM Defaults data warning	An attempt was made to use (or reset to) the OEM default settings (P199 = 1 or 2) using an MEM without valid OEM data.	Install an MEM containing valid OEM Defaults data
<b>LC</b> Fault Lockout	The drive attempted 5 restarts after a fault but all attempts were unsuccessful (P110 = 3...6)	<ul style="list-style-type: none"> <li>Drive requires manual reset</li> <li>Check Fault History (P500) and correct fault condition</li> </ul>
<b>PdEC</b> PID Deceleration Status	PID setpoint has finished its ramp but the drive is still decelerating to a stop.	
<b>PId</b> PID Mode Active	Drive has been put into PID Mode.	Refer to P200
<b>SLP</b> Sleep Mode is active	Refer to P240...P242	
<b>SP</b> Start Pending	The drive has tripped into a fault and will automatically restart (P110 = 3...6)	To disable Auto-Restart, set P110 = 0...2
<b>SPd</b> PID Mode disabled.	Drive has been taken out of PID Mode. Refer to P200.	
<b>StoP</b> Output frequency = 0 Hz (outputs U, V, W inhibited)	Stop has been commanded from the keypad, terminal strip, or network	Apply Start command (Start Control source depends on P100)

(1) The drive can only be restarted if the error message has been reset.



## Troubleshooting and Diagnostics

### 5.2 Drive Configuration Messages

When the Mode button is pressed and held, the drive's display will provide a 4-digit code that indicates how the drive is configured. If the drive is in a Stop state when this is done, the display will also indicate which control source commanded the drive to Stop (the two displays will alternate every second).

Configuration Display			
<b>Format = x.y.zz</b>	<b>x = Control Source:</b> L = Local Keypad t = Terminal Strip r = Remote Keypad n = Network	<b>y = Mode:</b> S = Speed mode P = PID mode t = Torque mode C = Sequencer mode	<b>zz = Reference:</b> CP = Keypad ▲ ▼ EU = 0-10 VDC (TB-5) E I = 4-20 mA (TB-25) JG = Jog nt = Network OP = MOP P L...P7 = Preset 1...7 Q L...16 = Sequencer Segment
<b>Example:</b> L_5_CP = Local Keypad Start control, Speed mode, Keypad speed reference t_P_EU = Terminal Strip Start control, PID mode, 0-10 VDC setpoint reference t_C_12 = Terminal Strip Start control, Sequencer Operation (Speed mode), Segment #12 n_t_P2 = Network Start control, Vector Torque mode, Preset Torque #2 reference n_5_03 = Network Start control, Speed mode, Speed reference from Sequencer segment #03			
Stop Source Display			
<b>Format = x_5tP</b>	L_5tP = Stop command came from Local Keypad t_5tP = Stop command came from Terminal Strip r_5tP = Stop command came from Remote Keypad n_5tP = Stop command came from Network		

### 5.3 Fault Messages

The messages below show how they will appear on the display when the drive trips. When looking at the Fault History (P500), the F\_ will not appear in the fault message.

Fault	Cause	Remedy <sup>(1)</sup>
<b>F_AF</b>	High Temperature fault Drive is too hot inside	<ul style="list-style-type: none"> <li>Reduce drive load</li> <li>Improve cooling</li> </ul>
<b>F_AL</b>	Assertion Level fault <ul style="list-style-type: none"> <li>Assertion Level switch is changed during operation</li> <li>P120 is changed during operation</li> <li>P100 or P121...P124 are set to a value other than 0 and P120 does not match the Assertion Level Switch.</li> </ul>	<ul style="list-style-type: none"> <li>Make sure the Assertion Level switch and P120 are both set for the type of input devices being used, prior to setting P100 or P121...P124.</li> <li>Refer to 3.2.3 and P120.</li> </ul>
<b>F_bF</b>	Personality fault Drive Hardware	<ul style="list-style-type: none"> <li>Cycle Power</li> <li>Power down and install MEM with valid data</li> <li>Reset the drive back to defaults (P199 = 3, 4) and then re-program</li> <li>If problem persists, contact factory technical support</li> </ul>
<b>F_cF</b>	Control fault An MEM has been installed that is either blank or corrupted	
<b>F_cF</b>	Incompatible MEM fault An MEM has been installed that contains data from an incompatible parameter version	
<b>F_cFt</b>	Forced Translation fault An MEM from an old drive put in new drive causes drive to trip F_cFT fault.	Press [M] (mode button) twice to reset

# Troubleshooting and Diagnostics



Fault		Cause	Remedy <sup>(1)</sup>
<b>F_dbF</b>	Dynamic Braking fault	Dynamic braking resistors are overheating	<ul style="list-style-type: none"> <li>• Increase active decel time (P105, P126, P127).</li> <li>• Check mains voltage and P107</li> </ul>
<b>F_EF</b>	External fault	<ul style="list-style-type: none"> <li>• P121...P124 = 21 and that digital input has been opened.</li> <li>• P121...P124 = 22 and that digital input has been closed.</li> </ul>	<ul style="list-style-type: none"> <li>• Correct the external fault condition</li> <li>• Make sure digital input is set properly for NC or NO circuit</li> </ul>
<b>F_F I</b>	ME fault	ME missing or defective	Power down and replace ME
<b>F_F2</b> ... <b>F_F I2</b>	Internal faults		Contact factory technical support
<b>F_Fnr</b>	Control Configuration Fault	The drive is setup for REMOTE KEYPAD control (P100=2 or 5) but is not setup to communicate with a remote keypad	Set P400 = 1, or P600 = 1
		The drive is setup for NETWORK ONLY control (P100=3) but is not setup for network communications	Set P400 or P600 to a valid network communications protocol selection
<b>F_FaL</b>	TB25 (4-20 mA signal) Threshold fault	4-20 mA signal (at TB-25) drops below the value set in P164.	<ul style="list-style-type: none"> <li>• Check signal/signal wire</li> <li>• Refer to parameters P163 and P164.</li> </ul>
<b>F_GF</b>	OEM Defaults data fault	Drive is powered up with P199 = 1 and OEM settings in the ME are not valid.	Install an ME containing valid OEM Defaults data or change P199 to 0.
<b>F_HF</b>	High DC Bus Voltage fault	Mains voltage is too high	Check mains voltage and P107
		Decel time is too short, or too much regen from motor	Increase active decel time (P105, P126, P127) or install Dynamic Braking option
<b>F_IL</b>	Digital Input Configuration fault (P121...P124)	More than one digital input set for the same function	Each setting can only be used once (except settings 0 and 3)
		Only one digital input configured for MOP function (Up, Down)	One input must be set to MOP Up, another must be set to MOP Down
		PID mode is entered with setpoint reference and feedback source set to the same analog signal	Change PID setpoint reference (P121...P124) or feedback source (P201).
		One of the digital inputs (P121...P124) is set to 10 and another is set to 11...14.	Reconfigure digital inputs
		One of the digital inputs (P121...P124) is set to 11 or 12 and another is set to 13 or 14.	
PID enabled in Vector Torque mode (P200 = 1 or 2 and P300 = 5)	PID cannot be used in Vector Torque mode		
<b>F_JF</b>	Remote keypad fault	Remote keypad disconnected	Check remote keypad connections
<b>F_LF</b>	Low DC Bus Voltage fault	Mains voltage too low	Check mains voltage
<b>F_n Id</b>	No Motor ID fault	An attempt was made to start the drive in Vector or Enhanced V/Hz mode prior to performing the Motor Auto-calibration	Refer to parameters P300...P399 for Drive Mode setup and calibration.
<b>F_n tF</b>	Module communication fault	Communication failure between drive and Network Module.	Check module connections
<b>F_nF I</b> ... <b>F_nF9</b>	Network Faults	Refer to the module documentation. for Causes and Remedies.	





## Troubleshooting and Diagnostics

Fault		Cause	Remedy <sup>(1)</sup>
<b>F_0F</b>	Output fault: Transistor fault	Output short circuit	Check motor/motor cable
		Acceleration time too short	Increase P104, P125
		Severe motor overload, due to: <ul style="list-style-type: none"><li>• Mechanical problem</li><li>• Drive/motor too small for application</li></ul>	<ul style="list-style-type: none"><li>• Check machine / system</li><li>• Verify drive/motor are proper size for application</li></ul>
		Boost values too high	Decrease P168, P169
		Excessive capacitive charging current of the motor cable	<ul style="list-style-type: none"><li>• Use shorter motor cables with lower charging current</li><li>• Use low capacitance motor cables</li><li>• Install reactor between motor and drive.</li></ul>
		Failed output transistor	Contact factory technical support
<b>F_0F I</b>	Output fault: Ground fault	Grounded motor phase	Check motor and motor cable
		Excessive capacitive charging current of the motor cable	Use shorter motor cables with lower charging current
<b>F_0F</b>	Motor Overload fault	Excessive motor load for too long	<ul style="list-style-type: none"><li>• Verify proper setting of P108</li><li>• Verify drive and motor are proper size for application</li></ul>
<b>F_0F</b>	Flying Restart fault	Controller was unable to synchronize with the motor during restart attempt; (P110 = 5 or 6)	Check motor / load
<b>F_0F</b>	Single-Phase fault	A mains phase has been lost	Check mains voltage
<b>F_0F</b>	Start fault	Start command was present when power was applied (P110 = 0 or 2).	<ul style="list-style-type: none"><li>• Must wait at least 2 seconds after power-up to apply Start command</li><li>• Consider alternate starting method (P110).</li></ul>
<b>F_0F</b>	TB5 (0-10V signal) Threshold fault	0-10V signal (at TB5) drops below the value set in P158.	<ul style="list-style-type: none"><li>• Check signal/signal wire</li><li>• Refer to parameters P157 and P158</li></ul>

(1) The drive can only be restarted if the error message has been reset.



**WTDR** | Drive for pool pump

**NOTES :**