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Firmware Manual

Doc Ver 1.02
Firmware Ver: 1.10
FC series drives
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For installation details refer to **Hardware Manual**

Safety:

- Read safety instruction in hardware manual before installation and commissioning drive.
- Some safety instructions associated with specific parameters should be complied with. These instructions are included in parameter description.

This manual is meant for qualified personnel with knowledge of electrical schematics, basic electrical circuits and wiring.

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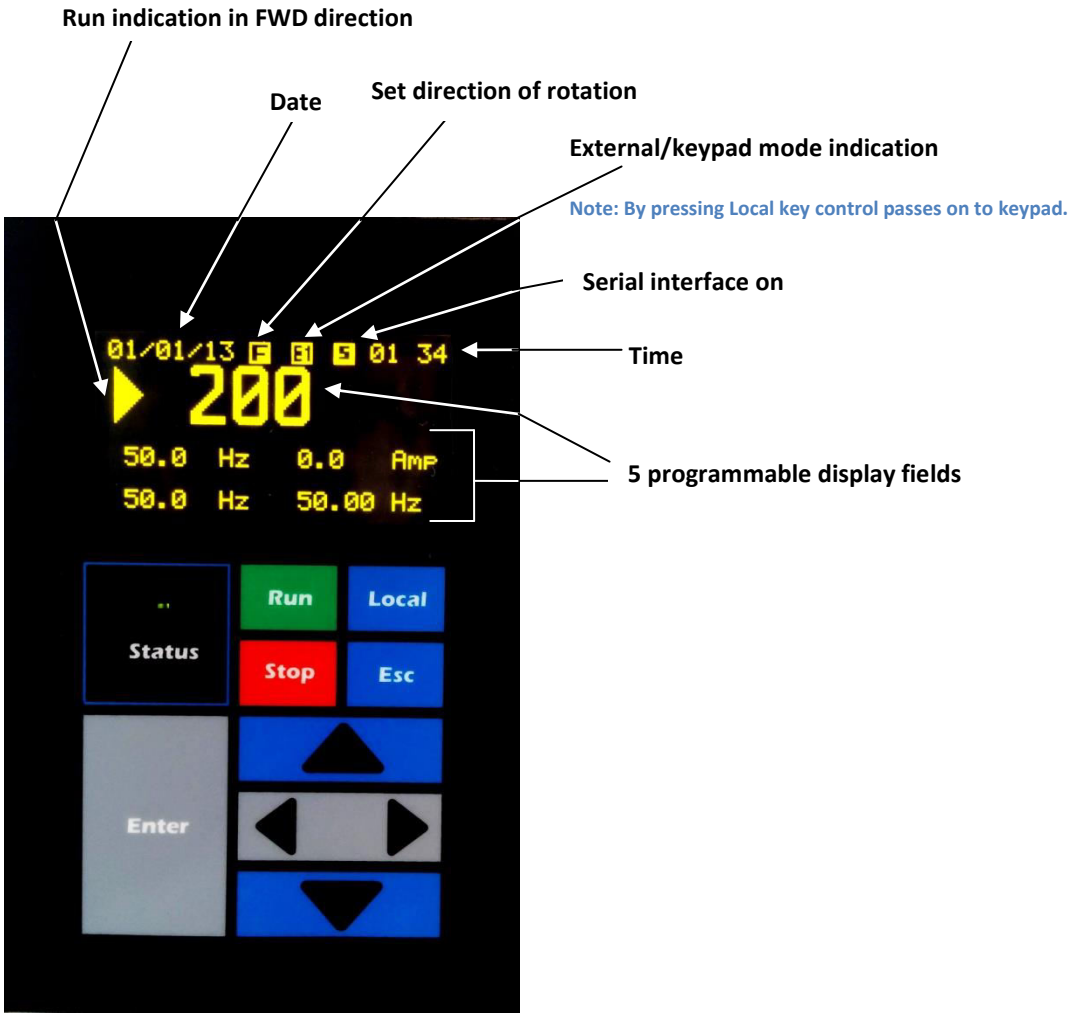
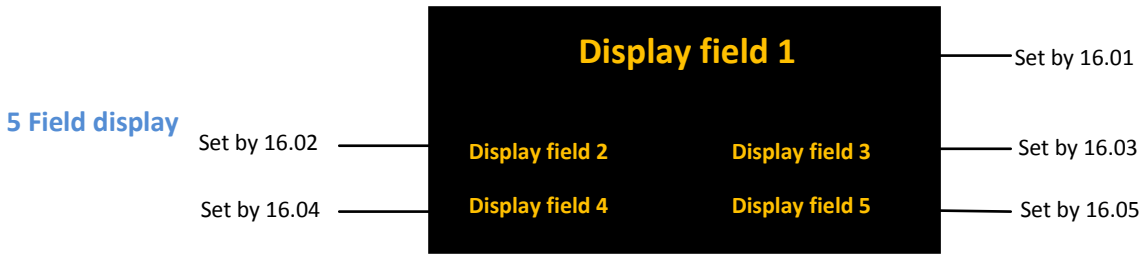
1. Display



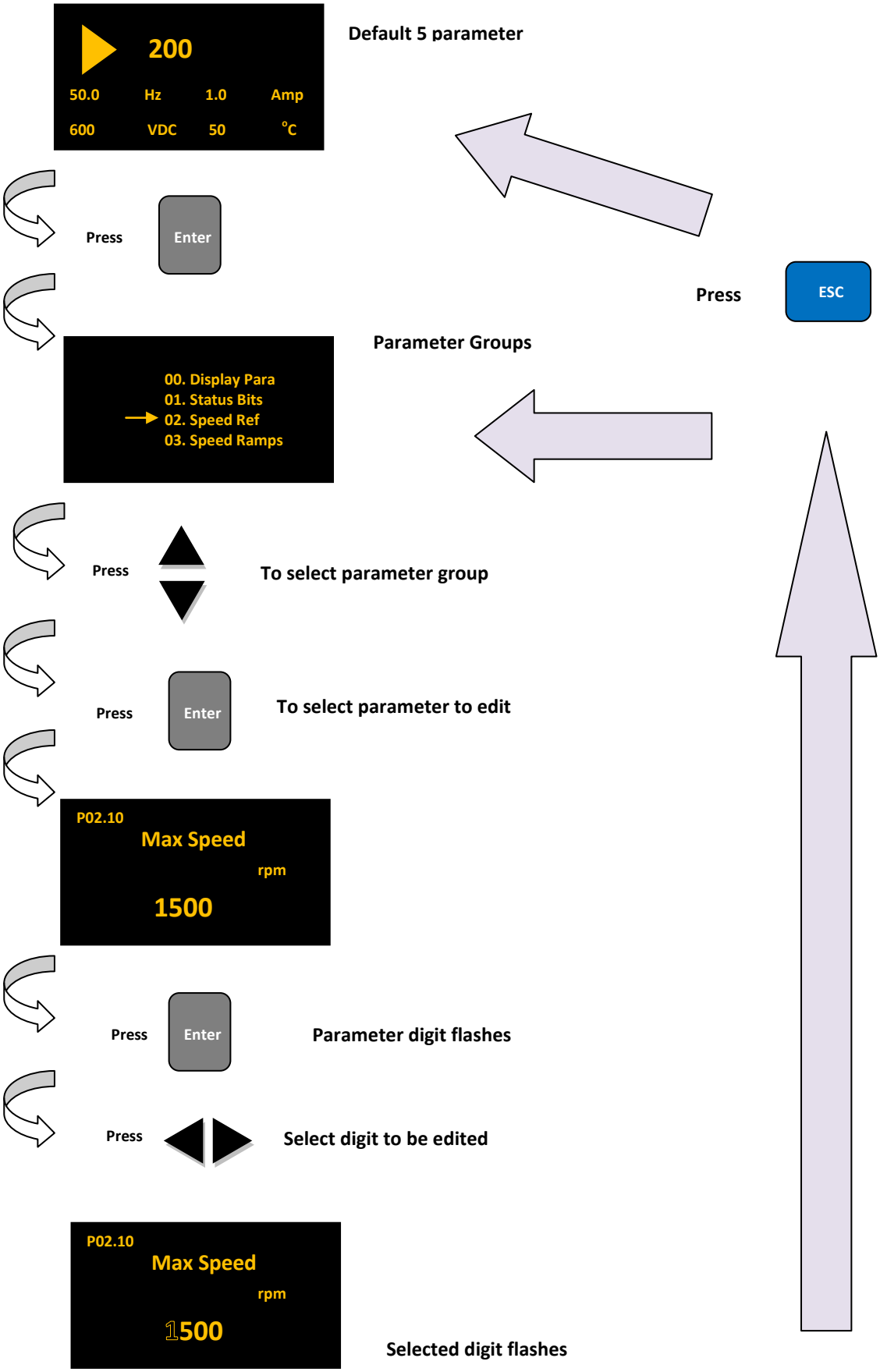
Typical Display in run

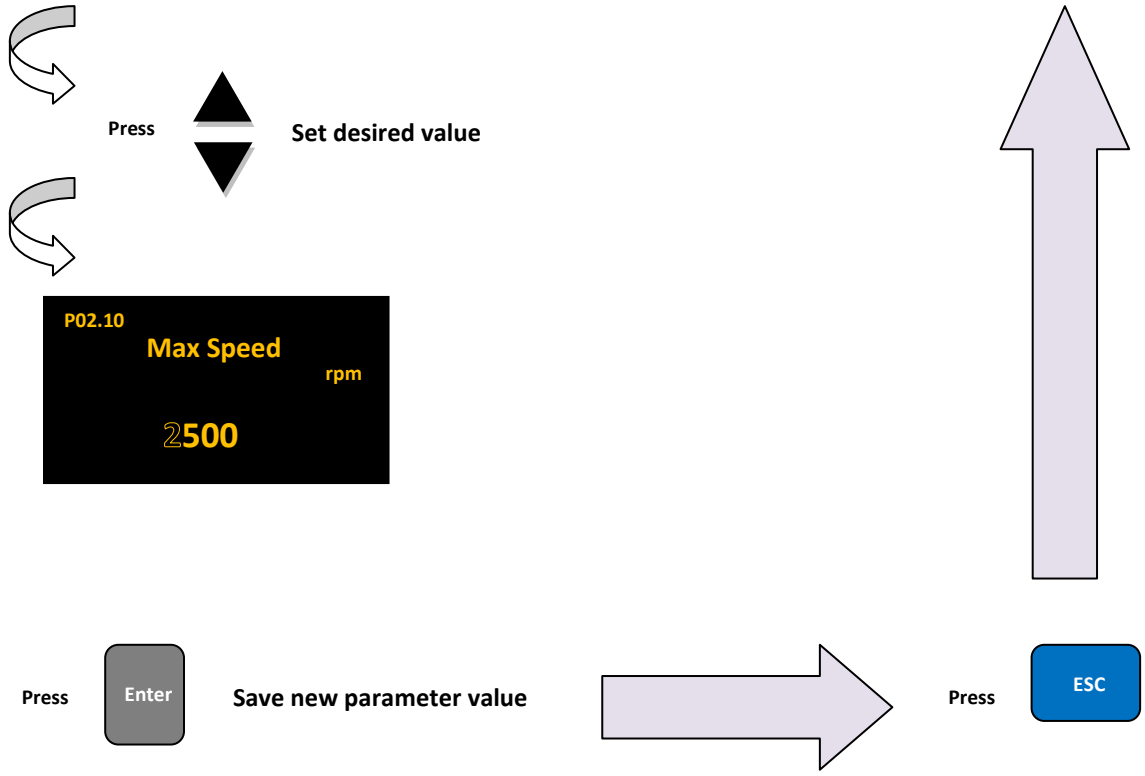
2. Selecting the display field

The two selectable display modes are shown below. **See Group 16**



3. Parameter setting method





4. Password

Parameter editing is blocked if user password is locked. Password lock can be opened upon entering password in parameter: **User Password** (**Pr19.06**)

5. Value and Bit Pointers

There are two types of pointers:

1. **Bit Pointers:**

Bit pointers point to status bits in group 1 and can be used as an input for many functions.
Format: Pxx.yy.bb
xx: parameter group
yy: parameter number
bb: Bit number with 15 as most significant bit.
E.g.: To setup a stop when timer0 status bit = 1
Set: Value of bit pointer in **Stop1** (Pr4.02) = **01.01.00** (pointing to timer0 status bit)

2. **Value Pointers:**

Value pointers point to 16b or 32b parameter values and can be used as input for many functions.
Format: Pxx.yy
xx: parameter group
yy: parameter number
E.g.: To setup analog output proportional to drive output current
Set: Analog output config (Pr10.01) = **00.07** (pointing to output current)

6. Constants

Parameters which are bit or value pointers can be assigned a constant value (0 or 1).
Sometimes this option is available as a parameter setting or pointers to constants 0 and 1 can be used.
To set a bit pointer or value pointer to **constant 0**: **Pr00.56**
To set a bit pointer or value pointer to **constant1**: **Pr00.57**

7. Quick Start up

Connect drive as per instructions in Hardware manual.
Parameters to be set for a quick start up in V/f mode:
These settings are for induction motor: 415VAC, 4pole, 50Hz

Step 1: According to motor ratings enter the following:

Para number	Parameter name	Set
11.01	Motor Nom Amps	As per motor name plate
12.00	Motor mode	V/f open loop
13.00	V/f curve	Linear

Parameters to be set for a quick start up in FOC mode (without encoder feedback):
These settings are for induction motor: 415VAC, 4pole, 50Hz

Step 1: According to motor ratings enter the following:

Para number	Parameter name	Set
11.01	Motor Nom Amps	As per motor ratings
11.05	Motor rated Power	
12.00	Motor mode	FOC open loop

14.01	Motor Parameter estimation	With rotation (if motor is not coupled to load)
		Standstill (if motor is coupled to load)
Give run command on keypad and allow parameter estimation to be completed.		
14.02	Inertia estimate	Enable (Load should be coupled to motor before starting inertia estimation)
Give run command on keypad for inertia estimation. After completion, drive is ready for operation in FOC mode without encoder		

8. Parameter Summary

Parameter types:

Uint: Unsigned integer value
Int: Signed integer value
Uint32: Unsigned 32b value
Int32: Signed 32b value
BW: Bit word
Txt: String
Bit Ptr: Bit pointer
Val Ptr: Value pointer
Bit: Single Bit

Group 0: Display Parameters

These parameters are for display purposes only. Any of these parameters can be displayed by setting up **Pr16.01** to **Pr16.05**

Parameter number	Parameter	Displayed as	Type	Unit
0.00	Set Frequency	Set Frequency	Int	Hz
0.01	Set Speed	Set Speed	Int	Rpm
0.02	Set Frequency as percentage	Set Frequency %	Int	%
0.03	Output Frequency	Output Frequency	Int	Hz
0.04	Motor Speed	Motor Speed	Int	Rpm
0.05	Motor Speed as percentage	Motor Speed %	Int	%
0.06	Compensated Output Frequency	Compensated Freq	Int	Hz
0.07	Output Current	Output Current	Int	Amps
0.08	Peak Output Current	O/P Current Peak	Int	Amps
0.09	Bus Voltage	DC Voltage	Uint	Volts
0.10	Output Voltage	Output Voltage	Uint	Volts
0.11	Power Output	Power	Uint	KW
0.12	Energy Output in KW-h	Energy KW-h	Uint	KW-h
0.13	Energy Output in MW-h	Energy MW-h	Uint	MW-h
0.14	Stator Resistance	Stator Res R(ohm)	Uint	ohm
0.15	Rotor Resistance	Rotor Res Rr(ohm)	Uint	ohm
0.16	Inductance in mH	Inductance Lm(mH)	Uint	mH
0.17	Leakage Inductance in mH	Leakage ind Ls(mH)	Uint	mH
0.18	Inertia in kg/m^2	Inertia $kg\text{-}m^2$ ($kg\text{-}m^2$)	Uint	$Kg\text{-}m^2$
0.19	Power up run time	Powerup Run time	Uint	Hr:min

0.20	Total Run time	Total run time	Uint	Hr:min
0.21	Total on time	Total on time	Uint	Hr:min
0.22	Counter value	Counter value	Uint	Nos
0.23	Heat sink temperature1	HS Temperature 1	Uint	^{o}C
0.24	Heat sink temperature2	HS Temperature 2	Uint	^{o}C
0.25	Heat sink temperature3	HS Temperature 3	Uint	^{o}C
0.26	CPU temperature	CPU Temperature	Uint	^{o}C
0.27	User defined parameter	User Value	Int	
0.28	Motor Torque	Motor Torque	Int	%
0.29	Encoder1 speed feedback	Encoder1 speed	Int	Hz
0.30	Encoder 1 final output	Enc1 Final o/p	Int	Hz
0.31	Encoder1 error	Enc1 speed error	Int	Hz
0.32	Encoder1 position	Encoder1position	Uint	
0.33	Encoder 2 speed feedback	Encoder2 speed	Int	Hz
0.34	Encoder2 final output	Enc2 Final o/p	Int	Hz
0.35	Encoder 2 error	Enc2 speed error	Int	Hz
0.36	Encoder2 position	Encoder 2 position	Uint	
0.37	Digital I/O status word	Dig I/O status	BW	
0.38	Relay o/p status bit	Relay o/p status	Bit	
0.39	Analog Input 1	AI1 input	Uint	Volts
0.40	Analog Input 2	AI2 input	Uint	Volts
0.41	Analog Input 3	AI3 input	Int	Volts
0.42	Analog Output 1	AO1 output	Uint	Volts
0.43	Analog Output 2	AO2 output	Uint	Volts
0.44	Frequency input	Frequency in	Int	Hz
0.45	Frequency output	Frequency out	Uint	Hz
0.46	Keypad reference	Keypad reference	Int	Hz
0.47	Analog input1 reference	Analog inp1 ref	Int	Hz
0.48	Analog input2 reference	Analog inp2 ref	Int	Hz
0.49	Analog input 3 reference	Analog inp3 ref	Int	Hz
0.50	Drive to Drive reference	D2D reference1	Int	Hz
0.51	Serial reference	D2D reference2	Int	Hz
0.52	Motorized potentiometer reference	Mot pot ref	Int	Hz
0.53	PID out reference	PID out ref	Int	Hz

0.54	PID error	PID Error	Int	
0.55	Brake resistor temperature estimate	Brak res temp es	Uint	%
0.56	Constant: 0	Constant 0	BW	
0.57	Constant:1	Constant 1	BW	
0.58	Fault record 1	Fault1 record	Txt	
0.59	Fault record 2	Fault2 record	Txt	
0.60	Fault record 3	Fault3 record	Txt	
0.61	Firmware version	Firmware version	Uint	

Group 1: Status Bits

These parameters are for read only.

Parameter number	Parameter	Displayed as	Type	Range
1.00	IO and logic functions	IO and logic func	BW	DIO1 Bit0 DIO2 Bit1 DIO3 Bit2 DI4 Bit3 DI5 Bit4 DI6 Bit5 DI7 Bit6 Logic func1 o/p Bit7 Logic func2 o/p Bit8
1.01	Timers	Timers	BW	Timer0 Status Bit0 Timer1 Status Bit1 Timer2 Status Bit2 Timer3 Status Bit3 Timer4 Status Bit4 Timer5 Status Bit5 Timer6 Status Bit6 Timer7 Status Bit7
1.02	General	General	BW	Brake command Bit0 Drive ready Bit1 Ext start cmd Bit2 Start command Bit3 Drive running Bit4 Alarm Bit5 Ext status Bit6 Em stop1 status Bit7 Em stop2 status Bit8 Fault Bit9 Loc/rem status Bit10 Pre charge relay Bit11 Negative speed Bit12 Zero speed Bit13 Above set speed Bit14 At set point Bit15

1.03	Alarm and trip	Alarm & Trip	BW	<table><tr><td>Supervision 1</td><td>Bit0</td></tr><tr><td>Supervision 2</td><td>Bit1</td></tr><tr><td>Supervision 3</td><td>Bit2</td></tr><tr><td>Analog Input Fault</td><td>Bit3</td></tr><tr><td>Under voltage</td><td>Bit4</td></tr><tr><td>Over voltage</td><td>Bit5</td></tr><tr><td>Over Current</td><td>Bit6</td></tr><tr><td>Short circuit</td><td>Bit7</td></tr><tr><td>Overtemp HS</td><td>Bit8</td></tr><tr><td>Inv Over temp</td><td>Bit9</td></tr><tr><td>Current limit</td><td>Bit10</td></tr><tr><td>Over Speed Trip</td><td>Bit11</td></tr><tr><td>Encoder Loss</td><td>Bit12</td></tr><tr><td>Phase Loss</td><td>Bit13</td></tr><tr><td>E2PROM read err</td><td>Bit14</td></tr></table>

Group 2: Speed Reference

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
2.00	Frequency reference 1	Frequency ref1	Txt + Val Ptr	Zero Ref Keypad Reference Analog inp1 ref Analog inp2 ref Analog inp3 ref D2D reference1 D2D reference2 Motorized pot rf PID out ref P.xx.yy	Keypad Reference	Hz	Read-Write
2.02	Frequency reference 2	Frequency ref2	Txt + Val Ptr		Analog inp3 ref	Hz	Read-Write
2.04	Reference select	Ref Select	Txt	Frequency ref 1 Frequency ref 2	Frequency ref 1		Read-Write
2.05	Reference operator	Ref Operator	Txt	No Operation Add Sub mul min max	No operation		Read-Write
2.06	Reference scale	Reference Scale	Int	-8.000 to 8.000	1.000		Read-Write
2.07	Jog1 ref	Jog1 Ref	Int	-3200.0 to 3200.0	150.0	Rpm	Read-Write
2.08	Jog2 ref	Jog2 Ref	Int	-3200.0 to 3200.0	300.0	Rpm	Read-Write
2.09	Safe speed	Safe speed	Uint	0 - 30000	750	Rpm	Read-Write
2.10	Rpm scale factor	Rpm scale factor	Uint	0 - 30000	1500	Rpm	Read-Write

2.11	Minimum speed	Min Speed	Uint	0 - 30000	15	Rpm	Read-Write
2.12	Maximum speed	Max Speed	Uint	0 - 30000	1500	Rpm	Read-Write
2.13	Positive speed select	Pos speed sel	Txt	Enable Disable	Enable		Read-Write
2.14	Negative speed select	Neg speed sel	Txt	Enable Disable	Disable		Read-Write
2.15	Direct reference Select	Direct Ref sel	Txt	Enable Disable	Disable		Read-Write
2.16	Direct ref value	Direct Ref value	Val Ptr	P.xx.yy	P.00.00		Read-Write
2.17	Motorized potentiometer mode	Mot Pot mode	Txt	zero @ power up last val @ pwrup user val @ strup	Zero at power up		Read-Write
2.18	Motorized pot rate	Mot Pot rate	Uint	0-250	10	Sec	Read-Write
2.19	Over speed threshold	Overspd Threshol	Uint	0-65535	300	Rpm	Read-Write

Group 3: Speed Ramps

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
3.00	Acceleration time1	Accel time 1	Uint32	0.001 – 3200.000	10.000	Sec	Read-Write
3.02	Acceleration time2	Accel time 2	Uint32	0.001 – 3200.000	10.000	Sec	Read-Write
3.04	Deceleration time1	Decel time 1	Uint32	0.001 – 3200.000	10.000	Sec	Read-Write
3.06	Deceleration time2	Decel time 2	Uint32	0.001 – 3200.000	10.000	Sec	Read-Write
3.08	S ramp acceleration time	S ramp acc time	Uint32	0– 2000.000	0.000	Sec	Read-Write
3.10	S ramp deceleration time	S ramp dec time	Uint32	0 – 2000.000	0.000	Sec	Read-Write
3.12	Jog acceleration time	Jog accel time	Uint32	0.001 – 2000.000	10.000	Sec	Read-Write
3.14	Jog deceleration time	Jog decel time	Uint32	0.001 – 2000.000	10.000	Sec	Read-Write

Group 4: Start/Stop

Parameter number	Parameter	Displayed as	Type	Range	Default	Runtime operability
4.00	External Run1	Run1(ext)	Txt+BitPtr	DIO1 DIO2 DIO3 DI4 DI5 DI6 DI7 constant: 0 constant:1 P.xx.yy.bb	DIO1	Read-Write
4.02	External Stop1	Stop1(ext)	Txt+BitPtr		DIO3	Read-Write
4.04	External Reverse1	Rev1(ext)	Txt+BitPtr		constant: 0	Read-Write
4.06	External Start/stop mode1	Ext Run/Stop1 md	Txt	3 wire Fwd Run/Rev RUN Run/Fwd DDI1 DDI2	3 wire	Read-Write
4.07	External Run2	Run2(ext)	Txt+BitPtr	DIO1 DIO2 DIO3 DI4 DI5 DI6 DI7 constant: 0 constant:1 P.xx.yy.bb	constant: 0	Read-Write
4.09	External Stop2	Stop2(ext)	Txt+BitPtr		constant: 0	Read-Write
4.11	External Reverse2	Rev2(ext)	Txt+BitPtr		constant: 0	Read-Write
4.13	External Start/stop mode2	Ext Run/Stop2 md	Txt	3 wire Fwd Run/Rev RUN Run/Fwd DDI1 DDI2	3 wire	Read-Write
4.14	Stop mode	Stop mode	Txt	Ramp Coast	Coast	Read-Write
4.15	Local stop	Stop key always	Txt	Enable Disable	Enable	Read-Write
4.16	Start mode	Start mode	Txt	No Rs measure Rs measure@str Rs messr @ pwrup	No Rs measure	Read-Write
4.17	Hold zero speed	Hold zero speed	Txt	Enable Disable	Disable	Read-Write

Group 5: Digital Inputs

Parameter number	Parameter	Displayed as	Type	Range	Default	Runtime operability
5.00	Jog1 start	Jog1 start	Txt+BitPtr	DIO1 DIO2 DIO3 DI4 DI5 DI6 DI7 constant: 0 constant:1 P.xx.yy.bb	DI4	Read-Write
5.02	Jog2 start	Jog2 start	Txt+BitPtr		constant: 0	Read-Write
5.04	Jog enable	Jog enable	Txt+BitPtr		constant: 0	Read-Write
5.06	Fault reset	Fault reset	Txt+BitPtr		constant: 0	Read-Write
5.08	Emergency stop1	Emergency stop1	Txt+BitPtr		constant: 0	Read-Write
5.10	Emergency stop2	Emergency stop2	Txt+BitPtr		constant: 0	Read-Write
5.12	Select external 1/ external 2	Select:EXT1/EXT2	Txt+BitPtr		constant: 0	Read-Write
5.14	Local/Remote	Loc/Rem	Txt+BitPtr		constant: 0	Read-Write
5.16	Speed reference 1/2 select	Speed ref1/2 sel	Txt+BitPtr		DI6	Read-Write
5.18	Motorized pot up	Mot pot up	Txt+BitPtr		DI5	Read-Write
5.20	Motorized pot down	Mot pot down	Txt+BitPtr		DI7	Read-Write
5.22	Acceleration/Deceleration select	acc/dec sel	Txt+BitPtr		constant: 0	Read-Write
5.24	Preset speed1 select	Preset speed sl1	Txt+BitPtr		constant: 0	Read-Write
5.26	Preset speed2 select	Preset speed sl2	Txt+BitPtr		constant: 0	Read-Write
5.28	Preset speed3 select	Preset speed sl3	Txt+BitPtr		constant: 0	Read-Write
5.30	External fault	External fault	Txt+BitPtr		constant: 0	Read-Write
5.36	Timer cycle on/off	Timer cyc on/off	Txt+BitPtr		constant: 0	Read-Write
5.38	Reset timers	Reset timers	Txt+BitPtr		constant: 0	Read-Write
5.40	Hold timers	Hold timers	Txt+BitPtr		constant: 0	Read-Write
5.42	Pulse Counter Reset	Pulse Cntr Reset	Txt+BitPtr		constant: 0	Read-Write
5.44	Pulse counter	pulse counter en	Txt+BitPtr		constant: 0	Read-Write
5.46	Digital input invert	Dig Inp Invert	BW	01111111b	00000000b	Read-Write
5.47	DI7	DI8 function	Txt	Pulse counter Frequency input	Pulse counter	Read-Write

Group 6: Digital Outputs

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
6.00	Digital I/O 1 direction	DIO1 direction	Txt	Input Output Frequency output	Input		Read-Write
6.01	Digital I/O 2 direction	DIO2 direction	Txt	Input Output	Input		Read-Write
6.02	Digital I/O 3 direction	DIO3 direction	Txt	Input Output	Input		Read-Write
6.03	Digital I/O 1 output configure	DIO1 o/p config	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
6.04	Digital I/O 1 turn on delay	DIO1 ton	Uint	0-3000.0	0.0	Sec	Read-Write
6.05	Digital I/O 1 turn off delay	DIO1 toff	Uint	0-3000.0	0.0	Sec	Read-Write
6.06	Digital I/O 2 output configure	DIO2 o/p config	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
6.07	Digital I/O 2 turn on delay	DIO2 ton	Uint	0-3000.0	0.0	Sec	Read-Write
6.08	Digital I/O 2 turn off delay	DIO2 toff	Uint	0-3000.0	0.0	Sec	Read-Write
6.09	Digital I/O 3 output configure	DIO3 o/p config	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
6.10	Digital I/O 3 turn on delay	DIO3 ton	Uint	0-3000.0	0.0	Sec	Read-Write
6.11	Digital I/O 3 turn off delay	DIO3 toff	Uint	0-3000.0	0.0	Sec	Read-Write
6.12	Relay Configure	Relay Config	Bit Ptr	P.xx.yy.bb	P.01.02.04		Read-Write
6.13	Relay on delay	Relay on delay	Uint	0-3000.0	0.0	Sec	Read-Write
6.14	Relay off delay	Relay off delay	Uint	0-3000.0	0.0	Sec	Read-Write

Group 7: Logic Functions

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
7.00	Logic function1 input1	Logic fun1 inp1	Txt + Bit Ptr	constant: 0 constant:1 P.xx.yy.bb	constant: 0		Read-Write
7.02	Logic function1 input1 invert	Logic f1 ip1 inv	Txt	Non Invert Invert	Non Invert		Read-Write
7.03	Logic function1 input2	Logic fun1 inp2	Txt + Bit Ptr	constant: 0 constant:1 P.xx.yy.bb	constant: 0		Read-Write

7.05	Logic function1 input2 invert	Logic f1 ip2 inv	Txt	Non Invert Invert	Non Invert		Read-Write
7.06	Logic function1 output invert	Logic f1 op inv	Txt	Non Invert Invert	Non Invert		Read-Write
7.07	Logic function1 output delay	Logic fun1 delay	Int	-25.0 to 25.0	0.0	Sec	Read-Write
7.08	Logic function2 input1	Logic fun2 inp1	Txt + Bit Ptr	constant: 0 constant:1 P.xx.yy.bb	constant: 0		Read-Write
7.10	Logic function2 input1 invert	Logic f2 ip1 inv	Txt	Non Invert Invert	Non Invert		Read-Write
7.11	Logic function2 input2	Logic fun2 inp2	Txt + Bit Ptr	constant: 0 constant:1 P.xx.yy.bb	constant: 0		Read-Write
7.13	Logic function2 input2 invert	Logic f2 ip2 inv	Txt	Non Invert Invert	Non Invert		Read-Write
7.14	Logic function2 output invert	Logic f2 op inv	Txt	Non Invert Invert	Non Invert		Read-Write
7.15	Logic function2 output delay	Logic fun2 delay	Int	-25.0 to 25.0	0.0	Sec	Read-Write

Group 8: Frequency Input, Output

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
8.00	Frequency input maximum	Freq in max	Uint	3-32768	50	Hz	Read-Write
8.01	Frequency input minimum	Freq in min	Uint	3-32768	3	Hz	Read-Write
8.02	Reference at Max Frequency	Freq in max ref	Int32	-32768.000 to 32768.000	50.000	Hz	Read-Write
8.04	Reference at Min Frequency	Freq in min ref	Int32	-32768.000 to 32768.000	0.500	Hz	Read-Write
8.06	Source of frequency output	Freq out config	Val Ptr	P.xx.yy	P.00.00		Read-Write
8.07	Reference for max frequency	Max o/p Freq	Int32	-32768.000 to 32768.000	50.000	Hz	Read-Write
8.09	Reference for min frequency	Min o/p Freq	Int32	-32768.000 to 32768.000	0.500	Hz	Read-Write
8.11	Frequency output maximum	Freq out max scl	Uint	3-32768	50	Hz	Read-Write
8.12	Frequency output minimum	Freq out min scl	Uint	3-32768	3	Hz	Read-Write

Group9: Analog Inputs

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
9.00	Analog input1 filter time	Anlg ip1 flt tim	Uint	0-30.000	0.100	Sec	Read-Write
9.01	Max voltage at analog input1	Anlg inp1 max	Uint	0-10.000	10.000	Volts	Read-Write
9.02	Min voltage at analog input1	Anlg inp1 min	Uint	0-10.000	0.000	Volts	Read-Write
9.03	Reference at Max analog input1	Anlg inp1 mx ref	Int32	-32768.000 to 32768.000	50.000	Hz	Read-Write
9.05	Reference at Min analog input1	Anlg inp1 mn ref	Int32	-32768.000 to 32768.000	0.500	Hz	Read-Write
9.07	Analog input2 filter time	Anlg ip2 flt tim	Uint	0-30.000	0.100	Sec	Read-Write
9.08	Max voltage at analog input2	Anlg inp2 max	Uint	0-10.000	10.000	Volts	Read-Write
9.09	Min voltage at analog input2	Anlg inp2 min	Uint	0-10.000	0.000	Volts	Read-Write
9.10	Reference at Max analog input2	Anlg inp2 mx ref	Int32	-32768.000 to 32768.000	50.000	Hz	Read-Write
9.12	Reference at Min analog input2	Anlg inp2 mn ref	Int32	-32768.000 to 32768.000	0.500	Hz	Read-Write
9.14	Analog input3 filter time	Anlg ip3 flt tim	Uint	0-30.000	0.100	Sec	Read-Write
9.15	Max voltage at analog input3	Anlg inp3 max	Int	-10.000 to 10.000	10.000	Volts	Read-Write
9.16	Min voltage at analog input3	Anlg inp3 min	Int	-10.000 to 10.000	0.000	Volts	Read-Write
9.17	Reference at Max analog input3	Anlg inp3 mx ref	Int32	-32768.000 to 32768.000	50.000	Hz	Read-Write
9.19	Reference at Min analog input3	Anlg inp3 mn ref	Int32	-32768.000 to 32768.000	0.500	Hz	Read-Write
9.21	Analog input supervisor setup	Anlg setup	Txt	AI1 max set AI1 min set AI2 max set AI2 min set AI3 max set AI3 min set	AI1 min set		Read-Write
9.22	Analog input supervisor action	Anlg inp sprvsor	Txt	No action Anlg inp fault Speed ref safe Last speed ref	No action		Read-Write

9.23	Analog input supervisor condition	Anlg inp condi	Txt	AI1< min AI1 > max AI2< min AI2 > max AI3< min AI3 > max	AI1<min		Read-Write

Group10: Analog outputs

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
10.00	Analog output1 filter time	Anlg op1 flt tim	Uint	0 - 30.000	0.100	Sec	Read-Write
10.01	Analog output1 configure	Anlg op1 cfg	Val Ptr	P.xx.yy	P.00.03		Read-Write
10.02	Reference for Max analog output1	Anlg op1 max ref	Int32	-32768.000 to 32768.000	50.000	Hz	Read-Write
10.04	Reference for Min analog output1	Anlg op1 min ref	Int32	-32768.000 to 32768.000	0.500	Hz	Read-Write
10.06	Analog output1 max voltage	Anlg op1 max	Uint	0 - 10.000V	10.000	Volts	Read-Write
10.07	Analog output1 min voltage	Anlg op1 min	Uint	0 - 10.000V	0.000	Volts	Read-Write
10.08	Analog output2 filter time	Anlg op2 flt tim	Uint	0 - 30.000	0.100	Sec	Read-Write
10.09	Analog output2 configure	Anlg op2 cfg	Val Ptr	P.xx.yy	P.00.03		Read-Write
10.10	Reference for Max analog output2	Anlg op2 max ref	Int32	-32768.000 to 32768.000	50.000	Hz	Read-Write
10.12	Reference for Min analog output2	Anlg op2 min ref	Int32	-32768.000 to 32768.000	0.500	Hz	Read-Write
10.14	Analog output2 max voltage	Anlg op2 max	Uint	0 - 10.000V	10.000	Volts	Read-Write
10.15	Analog output2 min voltage	Anlg op2 min	Uint	0 - 10.000V	0.000	Volts	Read-Write

Group11: Motor Data

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
11.00	Motor Type	Motor Type	Txt	Asynch Motor PMSM	Asynch Motor		Read only
11.01	Motor rated current	Motor Nom Amps	Uint	0-3200.0	4.6	Amps	Read only
11.02	Motor rated voltage	Motor rated volt	Uint	0 - 690	415	Volts	Read only

11.03	Motor rated frequency	Motor rated freq	Uint	0.1 - 1000.0	50.0	Hz	Read only
11.04	Motor rated speed	Motor rated spd	Uint	0 - 30000	1500	Rpm	Read only
11.05	Motor rated power	Motor rated pwr	Uint	0 - 1000.0	2.2	KW	Read only
11.06	Motor rated torque	Motor rated trq	Uint	0 - 3000.0	14.7	Nm	Read only
11.07	Motor Power factor	Mtr Power factor	Uint	0.000 - 1.000	0.860		Read only
11.08	Motor Number of Poles	Motor Poles	Uint	2-15	4		Read only
11.09	Stator Resistance	Stator Res Rs	Uint	0.0000 - 0.5000	0.0631	pu	Read only
11.10	Rotor Resistance	Rotor Res Rr	Uint	0.0000 - 0.5000	0.0468	pu	Read only
11.11	Stator Inductance	Inductance Lm	Uint	0.0000 - 6.5535	1.6531	pu	Read only
11.12	Leakage inductance	Leakage ind Ls	Uint	0.0000 - 6.5535	0.0936	pu	Read only
11.13	Motor and load Inertia	Inertia J(pu)	Uint	0.000 - 65.553	0.168	pu	Read only

Group12: Motor Control

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
12.00	Motor Control Mode	Motor mode	Txt	V/f open loop V/f closed loop FOC open loop FOC close loop	V/f Open loop		Read only
12.01	Switching Frequency	Switch Freq	Uint	1-15	3	KHz	Read only
12.02	IR Compensation	IR Compensation	Uint	0 – 50	0	%	Read only
12.03	Slip Compensation	Slip Compensati	Txt	Enable Disable	Disable		Read only
12.04	Slip Compensation gain	Slip gain	Uint	0.0-200.0	3.5	%	Read only
12.05	Slip speed Compensation (Kp)	Slip-spd gain Kp	Uint	0-65.535	0.700		Read only
12.06	Slip speed Compensation (Ki)	Slip- spd gain Ki	Uint	0-65.535	0.500		Read only
12.07	Slip-cu Compensation (Kp)	Slip-cu gain kp	Uint	0-6.5535	0.0030		Read only

12.08	Slip-cu Compensation (Ki)	Slip-cu gain ki	Uint	0-6.5535	0.0001		Read only
12.09	Current Limit	Current Limit	Uint	0-300	150	%	Read only
12.10	Current speed gain (Kp)	Cu-spd gain kp	Uint	0-65.535	0.100		Read only
12.11	Current speed gain (Ki)	Cu-spd gain ki	Uint	0-65.535	0.010		Read only
12.12	Current-cu gain (Kp)	Cu-cu gain kp	Uint	0-6.5535	0.0100		Read only
12.13	Current-cu gain (Ki)	Cu-cu gain ki	Uint	0-6.5535	0.0010		Read only
12.14	Current Hysteresis	Cu Hysteresis	Uint	0-500	100	%	Reserved
12.15	DC Bus Voltage Hysteresis	DC bus volt hyst	Uint	0-500	120	%	Reserved
12.16	Thermal Protection Curve	Thermal Prt curv	Txt	Continuous 1st curve select 2nd curve select	Continuous		Read-Write
12.17	Energy saving mode	Energy saving md	Txt	Enable Disable	Enable		Read-Write
12.18	Mains loss sensing level	Mains Loss Level	Uint	0-600	450	Volts	Read only

Group13: V/f Control

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
13.00	V/f curve type	V/f curve	Txt	Linear Quadratic User	Linear		Read only
13.01	V/f Voltage 1	V/f Volt1	Uint	0 - 1000	5	Volts	Read only
13.02	V/f Voltage 2	V/f Volt2	Uint	0 - 1000	83	Volts	Read only
13.03	V/f Voltage 3	V/f Volt3	Uint	0 - 1000	208	Volts	Read only
13.04	V/f Voltage 4	V/f Volt4	Uint	0 - 1000	332	Volts	Read only
13.05	V/f Voltage 5	V/f Volt5	Uint	0 - 1000	415	Volts	Read only
13.06	V/f Frequency 1	V/f Freq1	Uint	0 - 500.0	0.5	Hz	Read only
13.07	V/f Frequency 2	V/f Freq2	Uint	0 - 500.0	10.0	Hz	Read only
13.08	V/f Frequency 3	V/f Freq3	Uint	0 - 500.0	25.0	Hz	Read only
13.09	V/f Frequency 4	V/f Freq4	Uint	0 - 500.0	40.0	Hz	Read only
13.10	V/f Frequency 5	V/f Freq5	Uint	0 - 500.0	50.0	Hz	Read only

Group14: FOC Control

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
14.00	Flux Reference	Flux Ref	Uint	0-120	100	%	Read only
14.01	Motor Parameter estimation	Motor Para est	Txt	Off With mtr rotatn Standstill est	Off		Read only

14.02	Inertia Estimation	Inertia Estimate	Txt	Enable Disable	Disable		Read only
14.03	Speed controller proportional gain (Kp)	Spd ctr gain kp	Uint	0-655.35	11.42		Read only
14.04	Speed controller integral gain (Ki)	Spd ctr gain ki	Uint	0-65.535	0.042		Read only
14.05	Current controller proportional gain (Kp)	Cu ctr gain kp	Uint	0-65.535	0.199		Read only
14.06	Current controller integral gain (Ki)	Cu ctr gain ki	Uint	0-6.5535	0.0240		Read only
14.07	Flux controller proportional gain (Kp)	Flux ctr gain kp	Uint	0 - 65.535	0.130		Read only
14.08	Flux controller integral gain (Ki)	Flux ctr gain ki	Uint	0-6.5535	0.0060		Read only
14.09	Bandwidth	Bandwidth	Uint	0-255	10	Hz	Read-Write
14.10	Damping factor	Damping factor	Uint	0-10.0	0.1		Read-Write
14.11	Inertia Compensation	Inertia Compensa	Txt	Enable Disable	Disable		Read-Write

Group15: Preset Speeds

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
15.00	Preset Speed1	Preset Speed1	Int	-30000 to 30000	200	Rpm	Read-Write
15.01	Preset Speed2	Preset Speed2	Int	-30000 to 30000	400	Rpm	Read-Write
15.02	Preset Speed3	Preset Speed3	Int	-30000 to 30000	600	Rpm	Read-Write
15.03	Preset Speed4	Preset Speed4	Int	-30000 to 30000	800	Rpm	Read-Write
15.04	Preset Speed5	Preset Speed5	Int	-30000 to 30000	1000	Rpm	Read-Write
15.05	Preset Speed6	Preset Speed6	Int	-30000 to 30000	1200	Rpm	Read-Write
15.06	Preset Speed7	Preset Speed7	Int	-30000 to 30000	1400	Rpm	Read-Write

Group16: OLED Display and User Parameters

Parameter number	Parameter	Displayed as	Type	Range	Default	Runtime operability
16.00	Frame selection	Frame selection	Txt	Frame 1 Frame 2	Frame 1	Read-Write
16.01	Parameter 1 select	Signal 1 Select	Val Ptr	P.xx.yy	P.00.00	Read-Write
16.02	Parameter 2 select	Signal 2 Select	Val Ptr	P.xx.yy	P.00.03	Read-Write
16.03	Parameter 3 select	Signal 3 Select	Val Ptr	P.xx.yy	P.00.07	Read-Write
16.04	Parameter 4 select	Signal 4 Select	Val Ptr	P.xx.yy	P.00.09	Read-Write

16.05	Parameter 5 select	Signal 5 Select	Val Ptr	P.xx.yy	P.00.23	Read-Write
16.06	Time Display on/off	Time Display	Txt	ON OFF	ON	Read-Write
16.07	User value Pointer	User value Ptr	Val Ptr	P.xx.yy	P.00.03	Read-Write
16.08	User maximum reference	User ref max	Int	-320.00 to 320.00	50.00	Read-Write
16.09	User minimum reference	User ref min	Int	-320.00 to 320.00	0.00	Read-Write
16.10	User output maximum	User out max	Int	-320.00 to 320.00	50.00	Read-Write
16.11	User output minimum	Use out min	Int	-320.00 to 320.00	0.00	Read-Write

Group17: Modbus and DDI interface

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
17.00	DDI* interface	Interface sel	Txt	Disable DDI Modbus	Disable		Read-Write
17.01	Master Slave select	Master Slave sel	Txt	Master Slave	Slave		Read-Write
17.02	Slave address	Slave address	Uint	1-247	1		Read-Write
17.03	Baud rate	Baud rate	Txt	4800 9600 19200 38400	9600		Read-Write
17.04	Error response	Error response	Txt	No response Display error Dis err and stop	Display error		Read-Write
17.05	Modbus Protocol	Modbus Protocol	Txt	ASCII 7bit even parity 1 stop bit. ASCII 7bit odd parity 1 stop bit. RTU 8bit No parity 2 stop bits RTU 8bit Even parity 1 stop bit. RTU 8bit odd parity 1 stop bit.	RTU 8b No Parity 2Stop bits		Read-Write
17.06	Frame1 select	Frame1 select	Val Ptr	P.xx.yy	P.17.13		Read-Write
17.07	Frame1 address 08-01	Frame1 add 08-01	BW	11111111b	00000000b		Read-Write
17.08	Frame1 address 16-09	Frame1 add 16-09	BW	11111111b	00000000b		Read-Write
17.09	Frame1 address 24-17	Frame1 add 24-17	BW	11111111b	00000000b		Read-Write
17.10	Frame1 address 32-25	Frame1 add 32-25	BW	11111111b	00000000b		Read-Write

17.11	Frame Broadcast	Frame Broadcast	Val Ptr	P.xx.yy	P.00.00		Read-Write
17.12	Frame transmission interval	Master trans int	Uint	0.050 - 10.000	0.250	Sec	Read-Write
17.13	User command transmit	User command sel	BW	11111111b	00000000b		Read-Write

*DDI = Drive to Drive interface

Group18: Timers

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
18.00	Timer mode	Timer mode	Txt	Normal mode One cycle mode Cont cyclic md	Normal mode		Read-Write
18.01	Timer0 Control bit	Timer0 Cntrl bit	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
18.02	Timer0 value	Timer0 value	Uint32	0-86400.0	30.0	Sec	Read-Write
18.04	Timer1 Control bit	Timer1 Cntrl bit	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
18.05	Timer1 value	Timer1 value	Uint32	0-86400.0	30.0	Sec	Read-Write
18.07	Timer2 Control bit	Timer2 Cntrl bit	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
18.08	Timer2 value	Timer2 value	Uint32	0-86400.0	30.0	Sec	Read-Write
18.10	Timer3 Control bit	Timer3 Cntrl bit	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
18.11	Timer3 value	Timer3 value	Uint32	0-86400.0	30.0	Sec	Read-Write
18.13	Timer4 Control bit	Timer4 Cntrl bit	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
18.14	Timer4 value	Timer4 value	Uint32	0-86400.0	30.0	Sec	Read-Write
18.16	Timer5 Control bit	Timer5 Cntrl bit	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
18.17	Timer5 value	Timer5 value	Uint32	0-86400.0	30.0	Sec	Read-Write
18.19	Timer6 Control bit	Timer6 Cntrl bit	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
18.20	Timer6 value	Timer6 value	Uint32	0-86400.0	30.0	Sec	Read-Write
18.22	Timer7 Control bit	Timer7 Cntrl bit	Bit Ptr	P.xx.yy.bb	P.00.00.00		Read-Write
18.23	Timer7 value	Timer7 value	Uint32	0-86400.0	30.0	Sec	Read-Write

Group19: System Parameters

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
19.00	Bus gain	Bus gain	Uint				Read only
19.01	Current Ik	Current(Ik)	Uint				Read only
19.02	Drive Rating (HP)	Drive HP	Txt			HP	Read only

19.03	Heavy Duty Current	Heavy Duty Cu	Uint			Amps	Reserved
19.04	Status word	Status word	BW				Read only
19.05	E2prom default	E2prom default	Txt	Yes No	No		Read only
19.06	User Password	User Password	Uint	0-9999	0		Read-Write
19.07	Set User Password	Usr Password set	Uint	0-9999	0		Read-Write
19.08	System Password	System Password	Uint				Read only
19.09	Energy reset	Energy Reset	Txt	Yes No	No		Read-Write
19.10	Time set	Time set	Uint	00.00-23.59	00.00	Hr:min	Read-Write
19.11	Date set	Date set	Uint	1.01 to 31.12	1.01	Dt:Mnt	Read-Write
19.12	Year set	Year set	Uint	2000-9999	2013		Read-Write

Group21: Encoder

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
21.00	Encoder PPR	Encoder PPR	Uint	256-50000	1024		Read-Write
21.01	Encoder mode select	Encoder mode sel	Txt	QEP-AB select QEPA r&f edge select QEPA rising edge select	QEPA r&f edge sel		Read only
21.02	Encoder filter rate	Encoder flt rate	Uint	0-5.000	0.010	Sec	Read-Write
21.03	Proportional gain-Kp	Proprtnl gain-Kp	Uint	0-6.5535	0.0200		Read only
21.04	Integral gain-Ki	Integral gain-Ki	Uint	0-6.5535	0.0100		Read only
21.05	Encoder scale factor	Enc Ref scale	Uint	0-30.000	1.000		Read-Write
21.06	Encoder feedback loss	Encoder f/b loss	Txt	No action Trip Alarm	Alarm		Read-Write
21.07	Encoder Unit time	Enc Unit time	Uint	0-90.0	3.0	Sec	Reserved

Group22: Macros

Parameter number	Parameter	Displayed as	Type	Range	Default	Runtime operability
22.00	Macro 1 select 3 wire macro	MC1-3 wire mode	Txt	Disable Load parameter Store parameter	Disable	Read only
22.01	Macro 2 select Preset speed macro	MC2-Preset Speed	Txt		Disable	Read only
22.02	Macro 3 select	Macro3 select	Txt		Disable	Read only
22.03	Macro 4 select	Macro4 select	Txt		Disable	Read only

Group23: Supervision

Parameter number	Parameter	Displayed as	Type	Range	Default	Runtime operability
23.00	Supervisor function1	Superv1 function	Txt	Disable Below Min ref Above Max ref Min < function1 < max	Disable	Read-Write
23.01	Supervisor signal1	Superv1 signal	Val Ptr	P.xx.yy	P.00.00	Read-Write
23.02	Supervisor1 Max reference	Superv1 max ref	Int32	-32768.000 to 32768.000	50.000	Read-Write
23.04	Supervisor1 Min reference	Superv1 min ref	Int32	-32768.000 to 32768.000	0	Read-Write
23.06	Supervisor function2	Superv2 function	Txt	Disable Below Min ref Above Max ref Min < function1 < max	Disable	Read-Write
23.07	Supervisor signal2	Superv2 signal	Val Ptr	P.xx.yy	P.00.00	Read-Write
23.08	Supervisor2 Max reference	Superv2 max ref	Int32	-32768.000 to 32768.000	50.000	Read-Write
23.10	Supervisor2 Min reference	Superv2 min ref	Int32	-32768.000 to 32768.000	0	Read-Write
23.12	Supervisor function3	Superv3 function	Txt	Disable Below Min ref Above Max ref Min < function1 < max	Disable	Read-Write
23.13	Supervisor signal3	Superv3 signal	Val Ptr	P.xx.yy	P.00.00	Read-Write
23.14	Supervisor3 Max reference	Superv3 max ref	Int32	-32768.000 to 32768.000	50.000	Read-Write
23.16	Supervisor3 Min reference	Superv3 min ref	Int32	-32768.000 to 32768.000	0	Read-Write

Group24: Skip Frequency

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
24.00	Skip frequency select	Skip freq sel	Txt	Enable Disable	Disable		Read-Write
24.01	Skip frequency1 low	Skip freq1 low	Uint	0-30000	0	Rpm	Read-Write
24.02	Skip frequency1 high	Skip freq1 high	Uint	0-30000	0	Rpm	Read-Write
24.03	Skip frequency2 low	Skip freq2 low	Uint	0-30000	0	Rpm	Read-Write
24.04	Skip frequency2 high	Skip freq2 high	Uint	0-30000	0	Rpm	Read-Write
24.05	Skip frequency3	Skip freq3 low	Uint	0-30000	0	Rpm	Read-Write

	low						
24.06	Skip frequency3 high	Skip freq3 high	Uint	0-30000	0	Rpm	Read-Write

Group25: Fault Auto Reset

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
25.00	Auto Fault Reset Config	Auto Fault bit	BW	11111111b	0000000b		Read-Write
25.01	Number of attempts	No. of retries	Uint	0-5	3		Read-Write
25.02	Time between attempts	Time btw retries	Uint	0 - 150.0	10.0	Sec	Read-Write
25.03	Auto restart Time	Trial Time	Uint	1.0 - 600.0	10.0	Sec	Read-Write

Group26: PID

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
26.00	PID mode	PID mode	Txt	Enable Disable	Disable		Read-Write
26.01	Main ref source	Main Ref source	Txt + Val Ptr	Zero ref Analog inp1 ref Analog inp2 ref Analog inp3 ref D2D reference1 D2D reference2 P.xx.yy	Zero reference		Read-Write
26.03	PID set Point	PID set Point	Txt + Val Ptr		Analog in2 ref		Read-Write
26.05	PID Feedback source	PID F/b source	Txt + Val Ptr		Analog in3 ref		Read-Write
26.07	Set Point Invert	Set Point Invert	Txt	Invert Non invert	Non invert		Read-Write
26.08	Feedback source invert	Fb source invert	Txt	Invert Non invert	Non invert		Read-Write
26.09	Feedback source scale factor	Fb src scale fac	Int	-30.000 to 30.000	1.000		Read-Write
26.10	PID feedback max	PID F/b max	Int32	-32768.000 to 32768.000	50.000		Read-Write
26.12	PID feedback min	PID F/b min	Int32	-32768.000 to 32768.000	0		Read-Write
26.14	Set point filter	Set point filter	Uint	0-30.000	0.100	Sec	Read-Write
26.15	Feedback source filter	F/b sorce filter	Uint	0-30.000	0.100	Sec	Read-Write
26.16	Proportional gain	Proportion gain	Uint	0.000 – 65.535	0.100		Read-Write
26.17	Integral gain	Integral gain	Uint	0.000 – 65.535	0.010		Read-Write
26.18	Derivative gain	Derivative gain	Uint	0.000 – 65.535	0		Read-Write
26.19	PID upper limit	PID upper limit	Uint	0-999	50	%	Read-Write
26.20	PID lower limit	PID lower limit	Uint	0-999	50	%	Read-Write

26.21	PID output scale factor	PID op scale fac	Int	-30.000 to 30.000	1.000		Read-Write
26.22	Output filter time	O/P filter time	Uint	0-30.000	0.100	Sec	Read-Write

Group27: Torque Control

Parameter number	Parameter	Displayed as	Type	Range	Default	Runtime operability
27.00	Torque mode select	Torq md selector	Txt	Speed ctr mode Torq ref direct Tq spd over ride Spd tq Feed Fwd	Speed ctr mode	Read only
27.01	Torque Reference Select	Torque Ref Sel	Val Ptr	P.xx.yy	P.00.49	Read-Write
27.02	Torque Reference add	Torq Ref add	Val Ptr	P.xx.yy	P.00.56	Read-Write
27.03	Torque Reference maximum	Torq Ref max	Int	-1.00 to 3.00	1.00	Read-Write
27.04	Torque Reference minimum	Torq Ref min	Int	-1.00 to 3.00	0.00	Read-Write
27.05	Torque Reference Multiply	Torq Ref Mult	Int	-8.000 to 8.000	1.000	Read-Write
27.06	Torque ref ramp up	Torq Ref Ramp up	Uint	0.0 to 60.0	30.0	Read-Write
27.07	Torque ref ramp down	Torq Ref Ramp dw	Uint	0.0 to 60.0	30.0	Read-Write

Group28: DC injection and dynamic braking

Parameter number	Parameter	Displayed as	Type	Range	Default	Unit	Runtime operability
28.00	DC injection speed	DC injection spd	Uint	0-1000.0	10.0	Rpm	Read-Write
28.01	DC injection current	DC injection cu	Uint	0-100	0	%	Read-Write
28.02	DC injection time	DC injection tim	Uint	0-25.0	0	Sec	Read-Write
28.03	Brake chopper status	Brake chopper sl	Txt	Enable Disable	Disable		Read-Write
28.04	Max Braking Time	Max Braking Time	Uint	0-400.0	1.0	Sec	Read-Write
28.05	Braking interval	Braking interval	Uint	0-1500.0	1.0	Sec	Read-Write

Group 0 – Display Parameters

All parameters in this group are for read only.

Number	Parameter	Description	Unit
0.00	**Set Frequency**	Set frequency before ramp.	Hz
0.01	**Set Speed**	Set speed in rpm	Rpm
0.02	**Set Frequency %**	Set Frequency as a percentage of **Maximum speed ref**	%
0.03	**Output Frequency**	This is the ramp output frequency.	Hz
0.04	**Motor Speed**	Estimated motor speed	Rpm
0.05	**Motor Speed %**	Actual motor speed as a percentage of synchronous speed of motor	%
0.06	**Compensated Freq**	Actual frequency of motor output voltage as generated by the PWM generator. Typically this is the slip compensated output and may show some variations.	Hz
0.07	**Output Current**	Output current of the drive.	Amps
0.08	**Output Current Peak**	Peak output current of the drive. A new value is latched each time a run command is given after stop.	Amps
0.09	**Bus Voltage**	DC bus voltage	Volts
0.10	**Output Voltage**	Drive output voltage.	Volts
0.11	**Power Output**	Power output of the drive	KW
0.12	**Energy Output in KWh**	Energy output of the drive	KWh
0.13	**Energy Output in MWh**	Energy output of the drive	MWh
0.14	**Stator Resistance**	Stator resistance of motor	Ohm
0.15	**Rotor Resistance**	Rotor resistance of motor	Ohm
0.16	**Coil Inductance**	Inductance of motor coil	mH
0.17	**Leakage inductance**	Leakage Inductance of motor coil	mH
0.18	**Motor Inertia**	Inertia of motor	$Kg\text{-}m^2$
0.19	**Power up run time**	Total run time since last power up. On power up run time value is cleared.	Hr:min
0.20	**Total Run time**	Total drive run time till the present time. On power off run time value is saved.	Hr:min
0.21	**Total on time**	Total time for which drive has been powered up. This value is saved on power down.	Hr:min
0.22	**Counter value**	Input pulses at frequency input of the drive are counted. Maximum counter input frequency = 250Hz.	Nos
0.23	**Heat sink temperature 1**	Heat sink temperature as measured by NTC or PTC resistor inside the IGBT. In some models discrete NTC thermistors are mounted on heat sink. Over temperature protection is activated at 110degC.	^oC
0.24	**Heat sink temperature 2**	Heat sink temperature of drives with more than one heat sink.	^oC
0.25	**Heat sink temperature 3**	Heat sink temperature of drives with more than one heat sink.	^oC
0.26	**CPU temperature**	Junction temperature of the drive microcontroller. Max value = 125degC. There is no trip based on CPU temperature.	^oC
0.27	**User defined parameter**	This value is derived from parameters user value pointer **Pr16.07**, User Value Slope **Pr16.08** and User Value Constant **Pr16.10**.	

0.28	**Torque**	Motor output torque as a percentage of motor rated torque	%
0.29	**Encoder1 speed fb**	Actual speed feedback in Hz from encoder1. A moving average filter as per **Pr21.02** is applied to this value.	Hz
0.30	**Encoder 1 final output**	Speed ref to drive with encoder feedback.	Hz
0.31	**Encoder1 error**	Difference between set speed and encoder feedback.	Hz
0.32	**Encoder1 position**	Encoder1 position. There are 65535 positions in a revolution.	
0.33	**Encoder 2 speed**	Speed feedback from the encoder2. A moving average filter is applied as per **Pr21.02** to this value.	Hz
0.34	**Encoder 2 final output**	Speed ref to drive with encoder feedback.	Hz
0.35	**Encoder 2 error**	Difference between set speed and encoder feedback.	Hz
0.36	**Encoder2 position**	Encoder2 position. There are 65535 positions in a revolution	
0.37	**Digital I/O status word**	Format: DI1:DI2:DI3:In4:In5:In6:In7:In8. For digital inputs, 0 = active input, 1 = inactive input.	
0.38	**Relay o/p status bit**	0: relay off; 1: relay on	
0.39	**Analog Input 1**	Voltage at analog input 1. This is also the voltage across the burden resistor (500E) in case of current input.	Volts
0.40	**Analog Input 2**	Voltage at analog input 2. This is also the voltage across the burden resistor (500E) in case of current input.	Volts
0.41	**Analog Input 3**	Voltage at analog input 3	Volts
0.42	**Analog output 1**	Voltage at analog output 1.	Volts
0.43	**Analog output 2**	Voltage at analog output 2.	Volts
0.44	**Frequency input**	Input Frequency at user input **IN8**. Range: 3Hz to 32768Hz.	Hz
0.45	**Frequency output**	Output frequency at **DIO1**.Range: 3Hz to 32768hz.	Hz
0.46	**Keypad reference**	Speed reference set by keypad	Hz
0.47	**Analog input1 ref**	Speed reference set by AI1	Hz
0.48	**Analog input2 ref**	Speed reference set by AI2	Hz
0.49	**Analog input 3 ref**	Speed reference set by AI3	Hz
0.50	**D2D reference 1**	Speed reference set by DDI* interface	Hz
0.51	**D2D reference 2**	Speed reference via Modbus	Hz
0.52	**Motorized pot ref**	Speed ref set by motorized pot	Hz
0.53	**PID out ref**	Speed ref set by PID output	Hz
0.54	**PID error**	Difference between PID ref and PID feedback value	
0.55	**Brake resistor temperature est**	Estimated temperature of braking resistor	^{o}C
0.56	**Constant: 0**	Constant value 0 for use by bit or value pointers.	
0.57	**Constant: 1**	Constant value 1 for use by bit or value pointers.	
0.58	**Fault record 1**	Last 3 fault records. These faults exclude under voltage trip when power to the drive is cut off in stop condition.	
0.59	**Fault record 2**		
0.60	**Fault record 3**		
0.61	**Firmware version**	Installed firmware version	

* DDI : Drive to drive interface

Group 1 - Status Bits

Read only
Update rate: 1ms

1.00	**IO and logic functions**		
1.00.00	**DIO1**	**Bit0** active: 0	
1.00.01	**DIO2**	**Bit1** active: 0	
1.00.02	**DIO3**	**Bit2** active: 0	
1.00.03	**DI4**	**Bit3** active: 0	
1.00.04	**DI5**	**Bit4** active: 0	
1.00.05	**DI6**	**Bit5** active: 0	
1.00.06	**DI7**	**Bit6** active: 0	
1.00.07	**Logic func1 o/p**	**Bit7** **See Logic Function group**	
1.00.08	**Logic func2 o/p**	**Bit8**	
1.01	**Timers**		
1.01.00	**Timer0 Status**	**Bit0**	
1.01.01	**Timer1 Status**	**Bit1**	
1.01.02	**Timer2 Status**	**Bit2**	
1.01.03	**Timer3 Status**	**Bit3**	
1.01.04	**Timer4 Status**	**Bit4**	
1.01.05	**Timer5 Status**	**Bit5**	
1.01.06	**Timer6 Status**	**Bit6**	
1.01.07	**Timer7 Status**	**Bit7**	
1.02	**General**		
1.02.00	**Drive ready**	**Bit0**	
	Set when drive is ready for RUN command.		
1.02.01	**External RUN command**	**Bit1**	
	Set when external run command is issued. Run command from keypad has no effect.		
1.02.02	**RUN command**	**Bit2**	
	Set when run command is issued.		
1.02.03	**Drive running**	**Bit3**	
	Set if voltage is present at drive output		
1.02.04	**Alarm**	**Bit4**	
	Set in case of an alarm.		
1.02.05	**External status See Pr5.12**	**Bit5**	
	0: if EXT0 is selected; 1: if EXT1 is selected		
1.02.06	**Emergency stop1 status See Pr5.08**	**Bit6**	
	Set when emergency stop1 is activated		
1.02.07	**Emergency stop2 status See Pr5.10**	**Bit7**	
	Set when emergency stop2 is activated		
1.02.08	**Fault**	**Bit8**	
	Set in case of a drive fault.		
1.02.09	**Loc/remote status**	**Bit9**	
	0: Control from keypad 1: Control from user terminals		
1.02.10	**Pre charge relay**	**Bit10**	

	0: on power up till precharge relay operates 1: after pre charge relay operates		
1.02.11	**Negative speed**	**Bit11**	
	Set if output frequency of drive becomes negative		
1.02.12	**Zero speed**	**Bit12**	
	Set if output frequency of drive is below zero speed threshold (V/f freq 1). **See Pr13.06**		
1.02.13	**Above set speed**	**Bit13**	
	Set if output frequency of drive is above set speed.		
1.02.14	**At set point**	**Bit14**	
	Set if output frequency is equal to set frequency.		
1.03	**Alarms and Trips (Read only)**		
1.03.00	**Supervision 1**		
1.03.01	**Supervision 2**		
1.03.02	**Supervision 3**		
1.03.03	**Analog Input Fault**		
1.03.04	**Under voltage**	DC Bus < 300VDC	
1.03.05	**Over voltage**	DC Bus > 900VDC	
1.03.06	**Over Current**	Over current threshold exceeded	
1.03.07	**Short circuit**	Instantaneous over current threshold exceeded	
1.03.08	**Heat sink over temperature**	Over temperature threshold : 110degC	
1.03.09	**CPU over temperature**	CPU internal temperature threshold: 105^{o}C	
1.03.10	**Current limit**	Current limit active. See **Pr12.09**	
1.03.11	**Over Speed Trip**	Over speed limit exceeded. See **Pr2.19**	
1.03.12	**Encoder Loss**	Encoder feedback loss	
1.03.13	**Phase Loss**	Drive input phase loss	
1.03.14	**E2PROM read err**	Corrupt E2PROM data	

Group 2 - Speed Reference

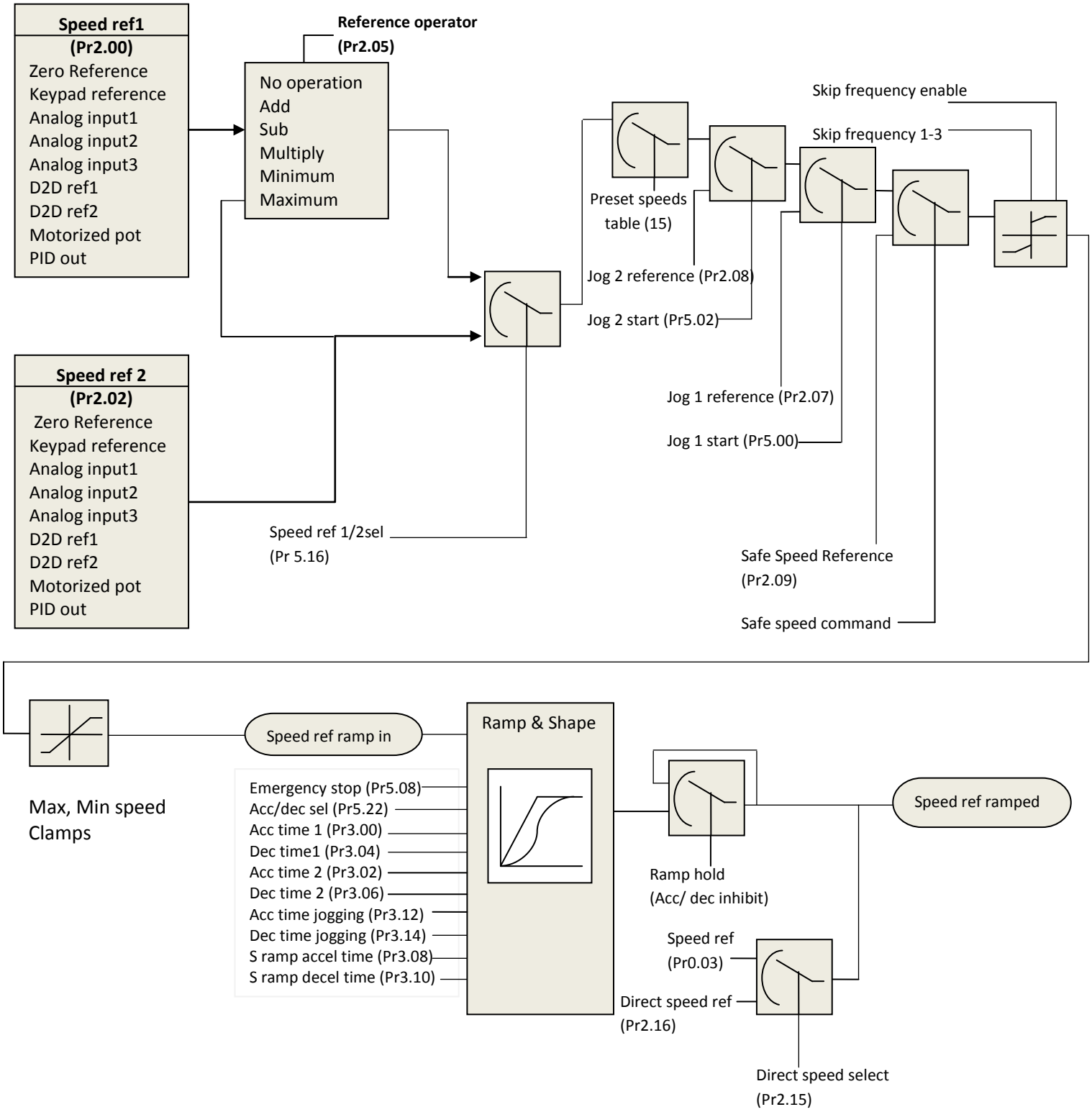


Fig-1

2.00 Frequency reference 1 2.02 Frequency reference 2	**Range:** 0: Zero Reference 1: Keypad reference 3: Analog input1 4: Analog input2 5: Analog input3 6: D2D reference1 7: D2D reference2 8: Motorized pot 9: PID out 10: Value Pointer
Default value: Keypad ref, Analog inp3 ref	
Displayed as : Frequency ref1, Frequency ref2	
Type: Txt + Value Pointer	
Description: Frequency ref1 or Frequency ref2 or combination of both (using **Pr2.05**) can be set up.	

2.04 Reference Select	**Range:** 0: Reference 1 1: Reference 2
Default value: Reference 1	
Displayed as : Ref Select	
Type: Txt	
Description: Select source of Frequency reference. This selection can also be done using user terminals.(**Pr5.16**)	

2.05 Reference Operator	**Range:** 0: No operation 1: Add 2: Sub 3: Multiply 4: Minimum 5: Maximum
Default value: Reference 1	
Displayed as : Ref Operator	
Type: Txt	
Description: Selects the math operator between Ref1 and Ref2. **For E.g.:** If Ref Operator = Add, output speed reference is Reference1 + Reference2.	

2.06 Reference Scale	**Range:** -8.000 to 8.000
Default value: 1.000	
Displayed as : Reference Scale	
Type: Int	
Description: Speed reference is multiplied by this scale factor.	

2.07 Jog1 Reference 2.08 Jog2 Reference	**Range:** -3200 to 3200 rpm
Default value: 150rpm	
Displayed as : Jog1 Ref, Jog2 Ref	
Type: Int	

2.09 Safe Speed Reference	**Range:** 0 - 30000rpm
Default value: 750 rpm	
Displayed as : Safe Speed	
Type: Int	
Description: This is the speed reference in case safe speed is invoked due to: 1. Analog input loss 2. Communication loss.	

2.11 Minimum speed	

Default value: 15rpm	**Range:** 0-30000rpm
Displayed as : Min Speed	
Type: Uint	
Description: Speed ref cannot be set below this value. **For E.g.:** If speed ref is to be limited in the range of -100rpm to 1400rpm, set Pr2.12 = 1400, Pr2.11 = 100, Pr2.13 = enable,Pr2.14 = enable(enable negative speed).For a range of 100rpm to 1400rpm, use the same settings except that Pr2.14 = disable(disable negative speed).	

2.12 Maximum speed	**Range:** 0-30000rpm
Default value: 1500rpm	
Displayed as : Max Speed	
Type: Uint	
Description: Speed ref cannot be set above this value. **For E.g.:** If a range of -1500rpm to 150rpm is required, set Pr2.12 = 150, Pr2.11 = 1500, Pr2.13 = enable, Pr2.14 = enable (enable negative speed).	

2.13 Positive speed enable	**Range:** 0: Disable 1: Enable
Default value: Enable	
Displayed as : Pos speed sel	
Type: Txt	
Description: If enabled positive speed reference can be set.	

2.14 Negative speed enable	**Range:** 0: Disable 1: Enable
Default value: Disable	
Displayed as : Neg speed sel	
Type: Txt	
Description: If enabled negative speed reference can be set.	

2.15 Direct reference select	**Range:** 0: Disable 1: Enable
Default value: Disable	
Displayed as : Direct Ref sel	
Type: Txt	
Description: If enabled, a direct ref value **Pr2.16** is the frequency reference and the ramp section is bypassed.	

2.16 Direct reference value	**Range:** Value Pointer
Default value: P.00.00	
Displayed as : Direct Ref value	
Type: Value Pointer	
Description: This is the speed ref if direct ref is selected**. See Pr2.15**	

2.17 Motorized potentiometer mode	**Range:** 0: 0 at power up 1: Last value at power up 2: User value at startup
Default value: 0 at power up	
Displayed as : Mot Pot mode	
Type: Txt	
Description: Motorized pot can be operated in the following modes: 0: Set ref is set to 0 at power up 1: Last value of motorized pot set frequency is restored at power up. Motorized pot has to be selected in **Pr2.00 or Pr2.02** for this purpose 2: A user value in **Pr16.10** is always set when run command is given.	

2.18 Motorized pot rate	
Default value: 10s	**Range:** 0-250s
Displayed as : Mot Pot rate	
Type: Uint	
Description: This is the time taken by the motorized pot to reach from 0 to 100% speed.	

2.19 Over speed threshold	
Default value: 300rpm	**Range:** 0-65535rpm
Displayed as : Overspd Threshol	
Type: Uint	
Description: Drive trips in over speed if this limit is exceeded in either direction. If set to 0 this limit is set to 1.2 times Max speed **Pr2.12**	

Group 3 - Speed Ramps

3.00 Acceleration Time 1 3.02 Acceleration Time 2	
Default value: 10.000s	**Range:** 0.0001-3200.000s
Displayed as : Accel time 1, Accel time 2	
Type: Uint32	
Description: Final frequency reference ramps up from 0 to motor rated frequency **Pr11.03** in this time. Acceleration time1 or 2 can be selected from Digital Input settings. See **Pr5.22**.	

3.04 Deceleration Time 1 3.06 Deceleration Time 2	
Default value: 10.000s	**Range:** 0.0001-3200.000s
Displayed as : Decel time 1, Decel time 2	
Type: Uint32	
Description: Final frequency reference ramps down from rated frequency **Pr11.03** to 0 in this time. Deceleration time1 or 2 can be selected from Digital Input settings. See **Pr5.22**.	

3.08 S ramp acceleration time	
Default value: 0s	**Range:** 0-2000.000s
Displayed as : S ramp acc time	
Type: Uint32	
Description: Due to S ramp ,start up acceleration time is high which then reduces till set acceleration is achieved. The variable acceleration time interval is set by this parameter. As the value of this parameter increases, drive starts with a larger acceleration time.	

3.10 S ramp deceleration time	
Default value: 0s	**Range:** 0-2000.000s
Displayed as : S ramp dec time	
Type: Uint32	
Description: Due to S ramp, initial deceleration time is high which reduces till set deceleration is achieved. The variable deceleration time interval is set by this parameter. As the value of this parameter increases, initial deceleration time increases and can be useful in stopping large inertia loads.	

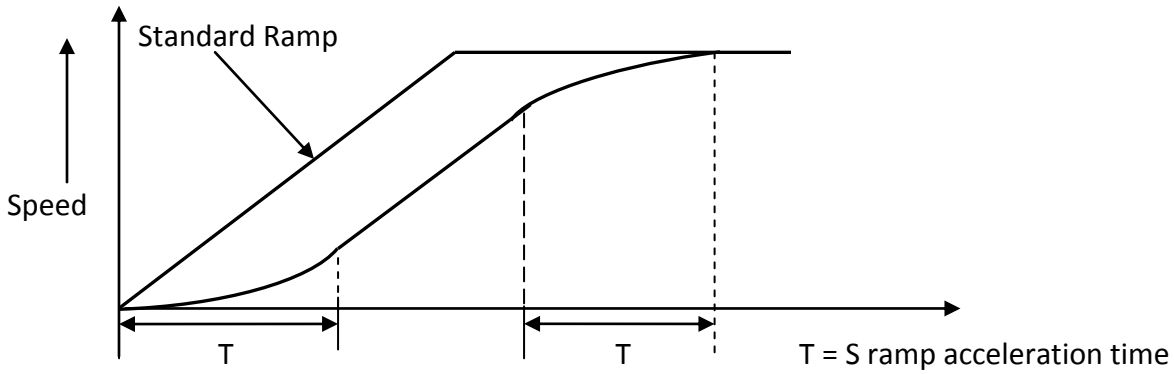


Fig-2

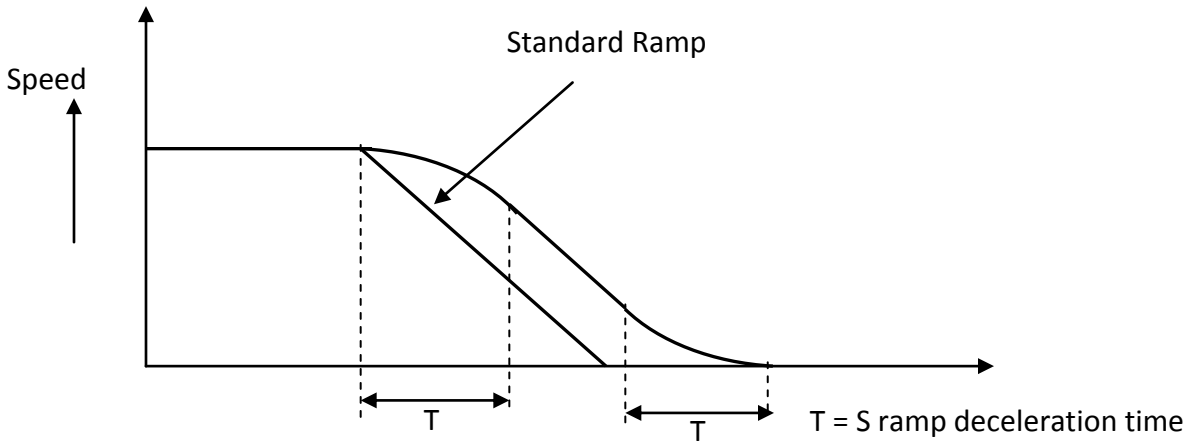


Fig-3

3.12 Jog Acceleration time **3.14 Jog Deceleration time**	
Default value: 10.000s	**Range:** 0.0001-2000.000s
Displayed as : Jog accel time, Jog decel time	
Type: Uint32	
Description: These are the ramp times when Jog is enabled. See **Pr5.04**	

Group 4 - Start / Stop

4.00 RUN1 **4.02 STOP1** **4.04 REV1** **4.07 RUN2** **4.09 STOP2** **4.11 REV2**	**Range:** 0: DIO1 1: DIO2 2: DIO3 3: DI4 4: DI5 5: DI6 6: DI7 7: constant: 0 8: constant:1 9: Bit Pointer
Default value: 4.00 DIO1 4.02 DIO3 4.04 constant: 0 4.07 constant: 0 4.09 constant: 0 4.11 constant: 0	
Displayed as : Run1(ext),Stop1(ext),REV1(ext),Run2(ext),Stop2(ext),REV2(ext)	
Type: Txt+Bit Ptr	
Description: Run1, Stop1, Rev1 are active if EXT1 is selected. Similarly Run2, Stop2, Rev2 are active if EXT2 is selected. **See Pr5.12**	

4.06 EXT START1/STOP1 Mode **4.13 EXT START2/STOP2 Mode**	**Range:** 0: 3 wire 1: FWD RUN/REV RUN 2: RUN/FWD 3: DDI1 4: DDI2
Default value: 3 wire	
Displayed as : Ext Run/Stop1 md , Ext Run/Stop2 md	
Type: Txt	

Description: Source of Start, Stop commands can be configured using this parameter.

3 wire mode:

RUN1 or RUN2	STOP1 or STOP2	Drive status
0 ----> 1(transition)	1	Start
Any	1 --->0 (transition)	Stop
Any	0	Stop

Note: RUN1 should be selected with Stop1. RUN2 should be selected with Stop2

FWD RUN/REV RUN:

RUN1	RUN2	Drive status
0	1	FWD Start
1	0	REV Start
0	0	Stop
1	1	Stop

External terminals should be set for RUN1 and RUN2. **See Pr4.00 & Pr4.07.**

RUN/FWD:

External terminals are set for RUN1 and REV1.

Start command is given when RUN1 is actuated (non-latching). Direction is selected by REV1 terminal.

DDI1: 1st drive to drive interface is the source of start/stop commands.

DDI2: 2nd drive to drive interface is the source of start/stop commands.

4.14 Stop mode	**Range:** 0: Ramp 1: Coast
Default value: Coast	
Displayed as : Stop mode	

Type: Txt	
Description: If Ramp stop is selected, drive decelerates to a stop on stop command. In coast mode, output voltage of the drive is removed on stop command and motor coasts to a stop.	

4.15 Local Stop	**Range:** 0: Disable 1: Enable
Default value: Enable	
Displayed as : Stop key always	
Type: Txt	
Description: If enabled, stop key on keypad is always functional. If disabled, stop key on keypad is functional only in 'Local' mode. Local mode selection can be done from keypad or external terminals. **See Local mode.**	

4.17 Hold zero speed	**Range:** 0: Disable 1: Enable
Default value: Disable	
Displayed as : Hold zero speed	
Type: Txt	
Description: If enabled, drive output supply is not cut off on stop command. A magnetizing flux is maintained in the motor even in stop condition. This enables a quick startup when a run command is given. This operation is valid for FOC mode only.	

Group 5 - Digital Inputs

0: Inactive, **1**: Active. Activation is by 24V applied to user terminal.
Inverted logic can be used by setting appropriate bits in **Pr5.48**.

Number	Parameter	Description	Default	Range
5.00	Jog1 start	Jog command. See Pr2.07	DI4	0: DIO1 1: DIO2 3: DIO3 4: DI4 5: DI5 6: DI6 7: DI7 8: Constant: 0 9: Constant:1 10: Bit Pointer
5.02	Jog2 start	Jog command. See Pr2.08	Constant: 0	
5.04	Jog enable	Jog1 start and Jog2 start can be activated only when Jog enable is active.	Constant: 0	
5.08	Emergency stop1	Emergency stop when Ext1 is active	Constant: 0	
5.10	Emergency stop2	Emergency stop when Ext2 is active	Constant: 0	
5.12	Select: EXT1/EXT2	0: Ext1 is selected(i.e RUN1,STOP1,REV1) 1: Ext2 is selected(i.e RUN2,STOP2,REV2)	Constant: 0	
5.14	Loc/Rem	0: Control from keypad 1: Control from external terminals	Constant: 0	
5.16	Speed ref 1/2 select	0: Speed reference 1 is selected 1: Speed reference 2 is selected	DI6	
5.18 5.20	Motorized pot up Motorized pot down	Set frequency can be increased or decreased with motorized pot. See Pr2.17	DI5 DI7	
5.22	Acceleration/ Deceleration Select	0: select Acceleration time1 and deceleration time1 1: select acceleration time2 and deceleration time2	Constant: 0	
5.24 5.26 5.28	Preset speed select1 Preset speed select2 Preset speed select3	See Group 15.	Constant: 0	
5.30	External fault	0: External Fault inactive 1: External Fault active and drive trips in external fault.	Constant: 0	
5.36 5.38 5.40	Timer cycle on/off Reset timers Hold timers	Cyclic mode is initiated. All timers are reset to 0. See Timers All timers pause and values are held.	Constant: 0	
5.42	Pulse Counter Reset	Resets Pulse counter using DI8.	Constant: 0	
5.44	Pulse counter enable	Enable pulse counting.	Constant: 0	
5.46	Acceleration/decelerati on inhibit	Acceleration/Deceleration timers are paused.	Constant: 0	
5.48	Dig Input Invert	Bits set are inverted for actuation. Actuation of these bits is with a 0V input. Bit word: DIO1-DIO2-DIO3-In1-In2-In3-In4-In5-In6(LSB)	00000000b	
5.49	DI8 function	0: Pulse counter 1: Frequency input (range: 3Hz to 32Khz)	Pulse counter	

Group 6 - Digital Outputs

6.00 Digital I/O 1 direction	**Range:** 0: Input 1: Output 2: Frequency Output
Default value: Input	
Displayed as : DIO1 direction	
Type: Txt	
Description: When set as frequency output frequency range is 3Hz - 32Khz.	

6.01 Digital I/O 2 direction **6.02 Digital I/O 3 direction**	**Range:** 0: Input 1: Output
Default value: Input	
Displayed as : DIO2 direction , DIO3 direction	
Type: Txt	

6.03 Digital I/O 1 output configure **6.06 Digital I/O 2 output configure** **6.09 Digital I/O 3 output configure**	**Range:** Bit Pointer
Default value: **P.00.00.00**	
Displayed as : DIO1 o/p config, DIO2 o/p config, DIO3 o/p config	
Type: Bit Pointer	
Description: Any of the status bits of **Group1** can be selected for output at DIO1, DIO2, DIO3 and Relay.	

6.12 Relay Configure	**Range:** Bit Pointer
Default value: P.01.02.04	
Displayed as : Relay Config	
Type: Bit Pointer	
Description: Any of the status bits of **Group1** can be selected for relay output.	

6.04 Digital I/O 1 turn on delay **6.05 Digital I/O 1 turn off delay** **6.07 Digital I/O 2 turn on delay** **6.08 Digital I/O 2 turn off delay** **6.10 Digital I/O 3 turn on delay** **6.11 Digital I/O 3 turn off delay** **6.13 Relay turn on delay** **6.14 Relay turn off delay**	**Range:** 0 – 3000.0s
Default value: 0.0s	
Displayed as : DIO1 ton, DO1 toff , DIO2 ton , DIO2 toff , DIO3 ton , DIO3 toff, Relay on delay , Relay off delay	
Type: Uint	
Description: DIOx output is set to 1 after a turn on delay. DIOx output is set to 0 after a turn off delay. See fig 4	

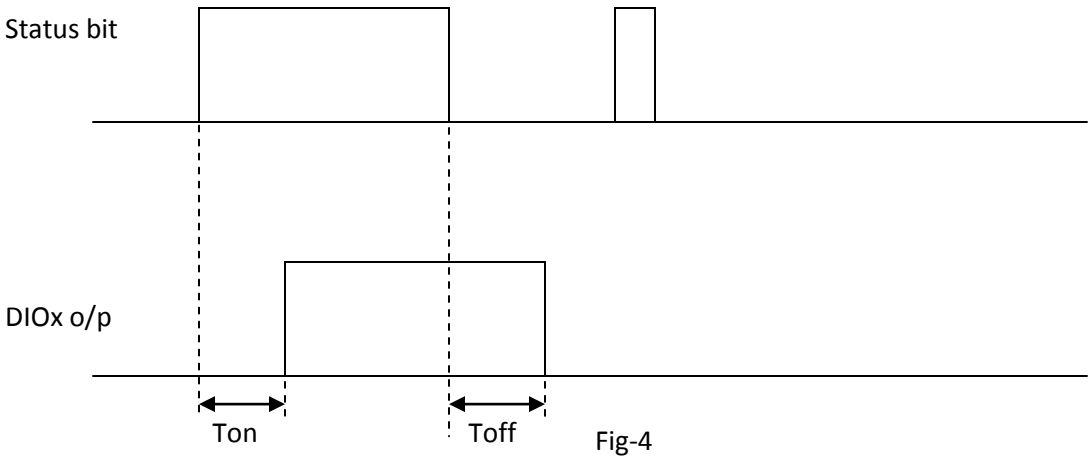


Fig-4

Ton: DIOx turn on delay set by **Pr6.04 , Pr6.07 or Pr6.10**

Toff: DIOx turn off delay set by **Pr6.05 , Pr6.08 or Pr6.11**

Group 7 - Logic Functions

7.00 Logic function1 input1 **7.03 Logic function1 input2** **7.08 Logic function2 input1** **7.11 Logic Function2 input2**	**Range:** 0: Constant: 0 1: Constant:1 2: Bit Pointer
Default value: constant: 0	
Displayed as: Logic fun1 inp1, Logic fun1 inp2, Logic fun2 inp1, Logic fun2 inp2.	
Type: Txt + Bit Pointer	
Description: Input1 and Input2 of each logic function are ANDed. Any of these inputs can be inverted. Output can also be inverted. Output of a logic function can be used as an input to another logic function.	

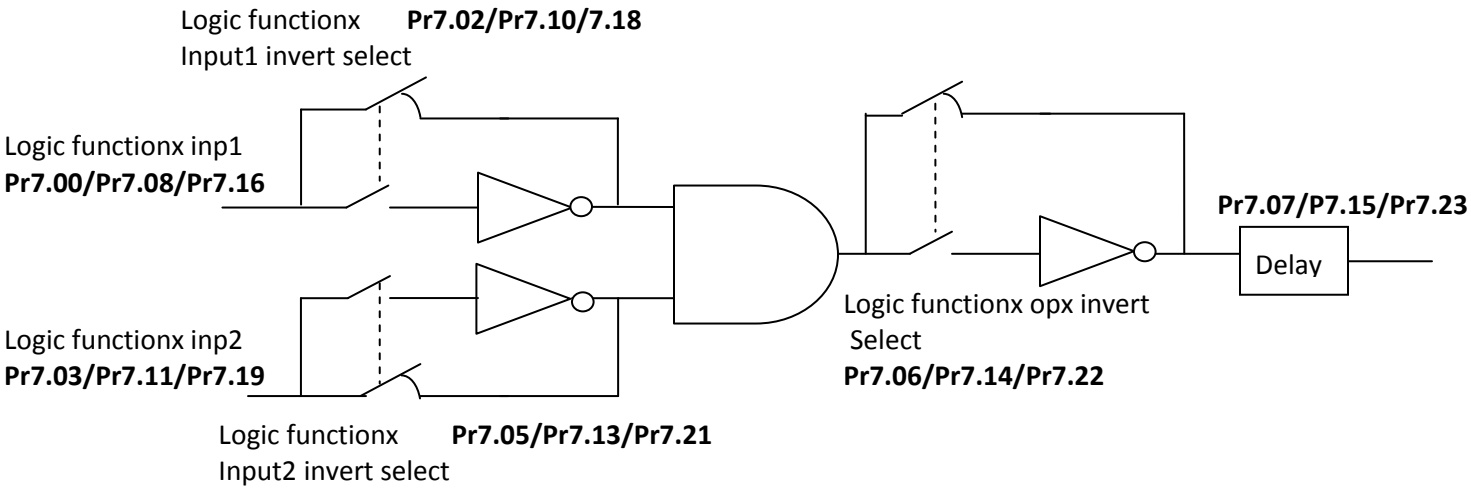


Fig-5

7.02 Logic function1 input1 invert **7.05 Logic function1 input2 invert** **7.06 Logic function1 output invert** **7.10 Logic function2 input1 invert** **7.13 Logic Function2 input2 invert** **7.14 Logic function2 output invert**	**Range:** 0: Non Invert 1: Invert
Default value: Non Invert	
Displayed as : Logic f1 ip1 inv, Logic f1 ip2 inv, Logic f1 op inv, Logic f2 ip1 inv, Logic f2 ip2 inv, Logic f2 op inv.	
Type: Txt	
Description: If enabled, function input or output can be inverted.	

7.07 Logic function1 output delay **7.15 Logic function2 output delay**	**Range:** 0 to ±25.0s
Default value: 0.0s	
Displayed as : Logic fun1 delay, Logic fun2 delay.	
Type: Int	
Description: Output is activated after the delay time if delay is positive. Output is held in the same state for the delay time if delay is negative.	

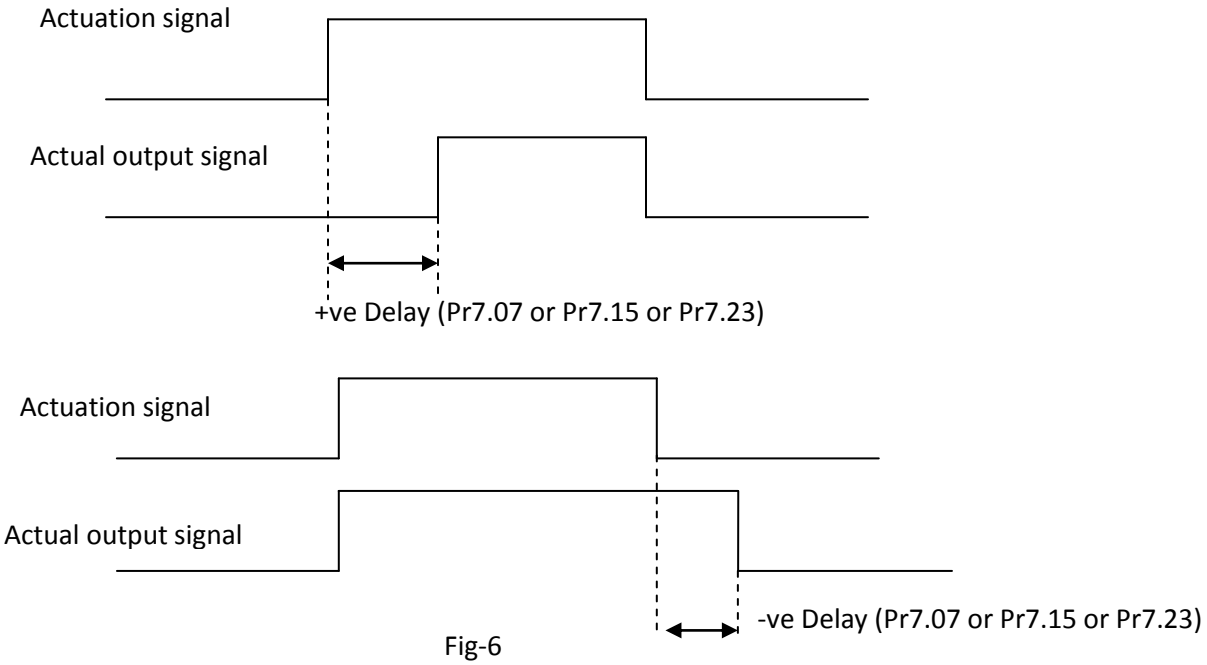


Fig-6

Group 8 - Frequency Input, Output

8.00 Frequency Input Maximum 8.01 Frequency Input Minimum	
Default value: 50Hz,3Hz	**Range:** 3 – 32768Hz
Displayed as : Freq in max , Freq in min	
Type: Uint	
Description: These are the maximum and minimum frequency values at input terminal In7.	

8.02 Reference at Max Frequency 8.04 Reference at Min Frequency	
Default value: 50.000Hz , 0.500Hz	**Range:** -32768.000 to 32768.000
Displayed as : Freq in max ref, Freq in min ref	
Type: Int32	
Description: This is the frequency ref at maximum frequency and the same at minimum frequency. Ref at any frequency $= \frac{\mathbf{Pr\,8.02 - Pr8.04}}{\mathbf{abs(Pr8.00 - Pr8.01)}}$ x Frequency in(in Hz at terminal In7)	

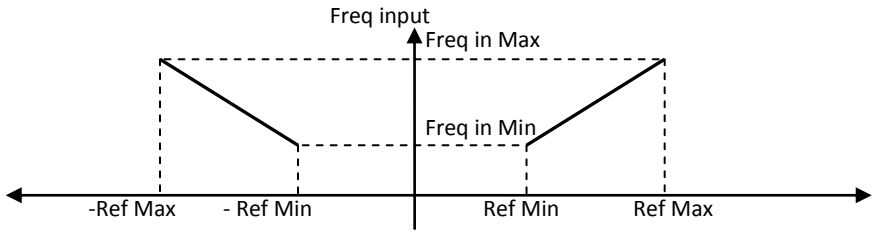


Fig-7

8.06 Source of frequency output	
Default value: P.00.00.00	**Range:** Value Pointer
Displayed as : Freq out config	
Type: Value Pointer	
Description: Select source of frequency output by setting appropriate value pointer. **For E.g.:** For Freq output proportional to Constant: 0 set value pointer to Pr00.00.51.	

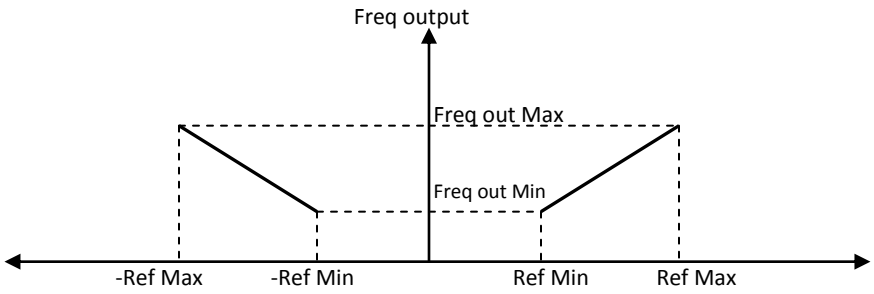


Fig-8

8.07 Reference for Max Frequency 8.09 Reference for Min Frequency	
Default value: 50.000Hz , 0.500Hz	**Range:** -32768.000 to 32768.000
Displayed as : Max o/p Freq, Min o/p Freq	

Type: Int32	
Description: This is the frequency ref for maximum frequency output and the same for minimum frequency output. Output frequency(at DIO1) = $\frac{\mathbf{Pr\,8.11 - Pr8.13}}{\mathbf{abs(Pr8.07 - Pr8.09)}}$ x Source of freq ref(Pr8.06)	

8.11 Frequency Output Maximum **8.13 Frequency Output Minimum**	
Default value: 50Hz,3Hz	**Range:** 3 – 32768Hz
Displayed as :	
Type: Uint	
Description: These are the maximum and minimum frequency values at output terminal DIO1.	

Group 9 - Analog Inputs

9.00 Analog input1 filter time **9.07 Analog input2 filter time** **9.14 Analog input3 filter time**	
Default value: 0.100s	**Range:** 0-30.000s
Displayed as : Anlg ip1 flt tim , Anlg ip2 flt tim , Anlg ip3 flt tim	
Type: Uint	
Description: This is the time constant of the moving average analog input filter. Increase this value for a noisy input line.	

9.01 Max voltage at analog input1 **9.02 Min voltage at analog input1** **9.08 Max voltage at analog input2** **9.09 Min voltage at analog input2**	
Default value: 10.000V,0V,10.000V,0V	**Range:** 0-10.000V
Displayed as : Anlg inp1 max, Anlg inp1 min, Anlg inp2 max ,Anlg inp1 min	
Type: Uint	

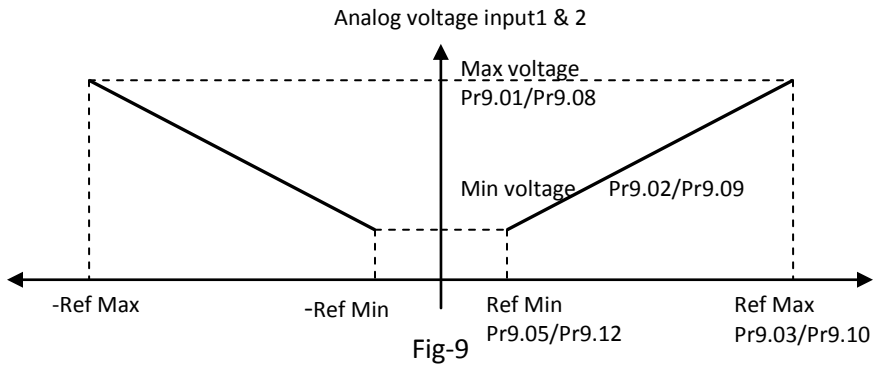


Fig-9

9.03 Reference at Max analog input1 **9.05 Reference at Min analog input1** **9.10 Reference at Max analog input2** **9.12 Reference at Min analog input2** **9.17 Reference at Max analog input3** **9.19 Reference at Min analog input3**	
Default value: 50.000Hz , 0.500Hz	**Range:** -32768.000 to 32768.000
Displayed as : Anlg inp1 mx ref , Anlg inp1 mn ref , Anlg inp2 mx ref , Anlg inp2 mn ref , Anlg inp3 mx ref , Anlg inp3 mn ref	
Type: Int32	
Description: This is the frequency ref at maximum input voltage and frequency ref at minimum input voltage. **Ref at analog voltage input1** $= \frac{\mathbf{Pr\,9.03 - Pr9.05}}{\mathbf{abs(Pr9.01 - Pr9.02)}}$ **x Analog input1(in volts)** **Note:** If analog current input is selected (0-20mA), consider 20mA as 10V input for above calculation.	

9.15 Max voltage at analog input3 **9.16 Min voltage at analog input3**	**Range:** -10.000V to 10.000V

Default value: 10.000V,0V	
Displayed as : Anlg inp3 max, Anlg inp3 min	
Type: Int	

Description: A bipolar input voltage can be applied to analog input 3.

Ref at analog voltage input3 $= \frac{\mathbf{Pr\,9.17 - Pr9.19}}{\mathrm{abs}(\mathbf{Pr9.15 - Pr9.16})}$ x Analog input3(in volts)

Note: Direction reversal can occur if polarity of reference changes.

For E.g.: If reference changes from 10hz to -5hz, direction of rotation changes. **Pr2.13** and **Pr2.14** should be appropriately set).

Analog voltage input3

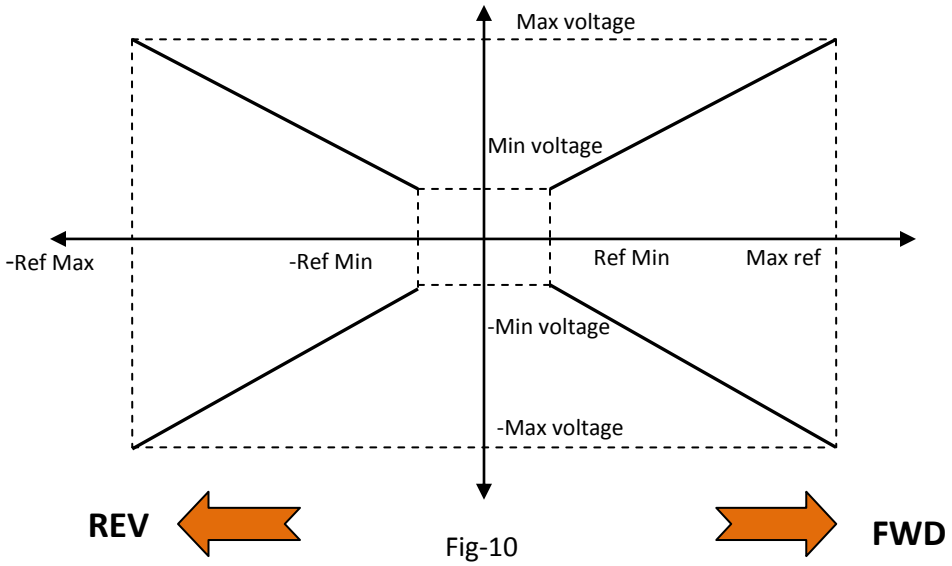


Fig-10

9.21 Analog input setup	**Range:**
Default value: AI1 min set	0: AI1 max set 1: AI1 min set 2: AI2 max set 3: AI2 min set 4: AI3 max set 5: AI3 min set
Displayed as : Anlg setup	
Type: Txt	

Description: Maximum and minimum analog input voltages can be set automatically. A voltage corresponding to maximum input voltage(say AI2) is set by applying this voltage at input terminal and setting this parameter for '**AI2 max set'.** Max voltage input (**Pr9.08**) is now saved. Now a voltage corresponding to min input voltage(again say AI2) is set by giving this voltage at input terminal and setting this parameter for **'AI2 min set'.** Min voltage input**(Pr9.09)** is now saved.

9.22 Analog input supervisor action	**Range:**
Default value: No action	0: No action 1: Anlg inp fault 2: Speed ref safe 3: Last speed ref
Displayed as : Anlg inp sprvsor	
Type: Txt	

Description: In case of activation of analog supervisor by the conditions in **Pr9.21** the following sequences are possible:

0. No action is taken
1. Drive trips on analog input fault
2. Drive switches to safe speed ref. See **Pr2.09**

3. Drive switches to last speed ref before analog supervisor is activated.

9.23 Analog input supervisor condition	**Range:** 0: AI1 < min voltage Pr9.02 1: AI1 > max voltage Pr9.01 2: AI2 < min voltage Pr9.07 3: AI2 > max voltage Pr9.06 4: AI3 < min voltage Pr9.12 5: AI3 > max voltage Pr9.11
Default value: AI1<min	
Displayed as : Anlg inp condi	
Type: Txt	
Description: Any of the above conditions can be selected for supervision.	

Group 10 - Analog Outputs

10.00 Analog output1 filter time **10.08 Analog output2 filter time**	**Range:** 0 – 30.000s
Default value: 0.100s	
Displayed as : Anlg op1 flt tim , Anlg op2 flt tim	
Type: Uint	
Description: This is the analog output filter time constant.	

10.01 Analog output1 configure **10.09 Analog output2 configure**	**Range:** Value Pointer
Default value: P.00.03,P.00.03 (prop to Output frequency)	
Displayed as : Anlg op1 cfg , Anlg op2 cfg	
Type: Value Pointer	
Description: Signal selected by value pointer is available as analog output. **Note:** For analog current output(0-20mA), 10V results in 20mA current output	

10.06 Analog output1 max voltage **10.07 Analog output1 min voltage** **10.14 Analog output2 max voltage** **10.15 Analog output2 min voltage**	**Range:** 0 – 10.000V
Default value: 10.000V,0V,10.000V,0V	
Displayed as : Anlg op1 max, Anlg op1 min, Anlg op2 max, Anlg op2 min	
Type: Uint	
Description: For 12bit analog output, DAC1 jumper should be selected. **Note:** For analog current output(0-20mA), 10V results in 20mA current output	

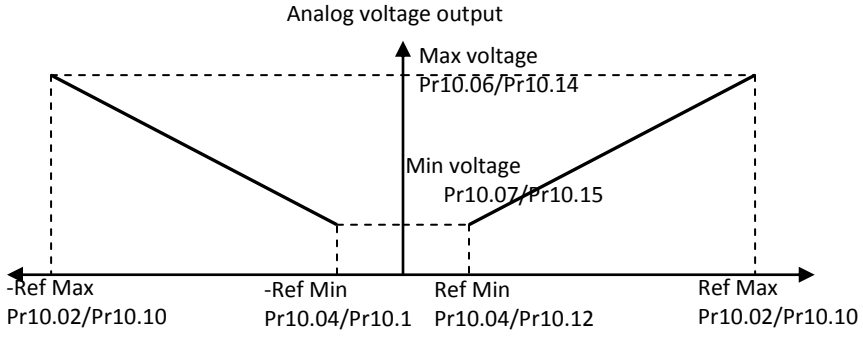


Fig-11

10.02 Reference for Max analog output1 **10.04 Reference for Min analog output1** **10.10 Reference for Max analog output2** **10.12 Reference for Min analog output2**	**Range:** -32768.000 to 32768.000
Default value: 50.000, 0.500,50.000, 0.500	
Displayed as : Anlg op1 max ref, Anlg op1 min ref, Anlg op2 max ref, Anlg op2 min ref	
Type: Int32	

Description: This is the ref (Pr10.02, Pr10.10) at which maximum output voltage is generated and the ref (Pr10.04, Pr10.12) at which minimum output voltage is generated.

analog output voltage1 $= \frac{\mathbf{Pr\ 10.06 - Pr10.07}}{\mathbf{abs(Pr10.02 - Pr10.04)}}$ **x** Pr10.01(value pointer)

For E.g.: To generate a 10V at analog output1 at rated current, Pr10.06 = 10.000, Pr10.07 = 0, Pr10.01 = 00.03, Pr10.02 = Rated current(e.g.:16.0A for 10hp),Pr10.04 = 0.

Group 11 - Motor Data

11.00 Motor Type	Range:
Default value: Induction motor	0: Asynch Motor 1: PMSM motor
Displayed as : Motor type	
Type: Txt	
Description: Select the type of motor. PMSM motor should be used with a rotor position feedback device, For E.g.**:** Absolute encoder.	

11.01 Motor rated current	**Range:** 0 – 3200.0A
Default value: 4.6A	
Displayed as : Motor Nom Amps	
Type: Uint	
Description: This is the rated current as shown on the name plate of the motor. If this current exceeds the rated current of the drive, the rated current of the drive takes precedence. In that case over current trip and current limits would be set as per drive rated current. **If Motor rated current <= Drive heavy duty rated current, 200% heavy duty rated current is available for 3sec.** **If Motor rated current >= Normal duty current rating of the drive, 110% normal duty current is available.**	

11.02 Motor rated Voltage	**Range:** 0 – 690V
Default value: 415V	
Displayed as : Motor rated volt	
Type: Uint	

11.03 Motor rated frequency	**Range:** 0.1 – 1000.0Hz
Default value: 50Hz	
Displayed as : Motor rated freq	
Type: Uint	
Description: The rated frequency of the motor should be entered here. Motor voltage **Pr11.02** along with motor rated frequency is used to determine V/f curve applied to the motor.	

11.04 Motor rated speed	**Range:** 0 – 30000rpm
Default value: 1500rpm	
Displayed as : Motor rated spd	
Type: Uint	
Description: Motor rated speed on name plate is used to determine rated slip of motor. This is utilized in slip compensation and field oriented control of motor.	

$$\text{Rated slip(hz)} = \text{rated motor frequency} - \frac{\text{no of poles x motor full load rpm}}{120}$$

$$= \text{Pr11.03} - \frac{\text{Pr11.08 x Pr11.04}}{120}$$

11.05 Motor rated power	**Range:** 0 – 1000.0kw
Default value: 2.2kw	
Displayed as : Motor rated pwr	
Type: Uint	
Description: Rated motor power in KW. This value is utilized in auto tuning. **See 14.01 & 14.02**	

11.07 Motor Power factor	Range: 0 – 1.000
Default value: 0.860	
Displayed as : Mtr Power factor	
Type: Uint	
Description: Rated motor power factor is used to determine magnetizing current of the motor for slip compensation.	

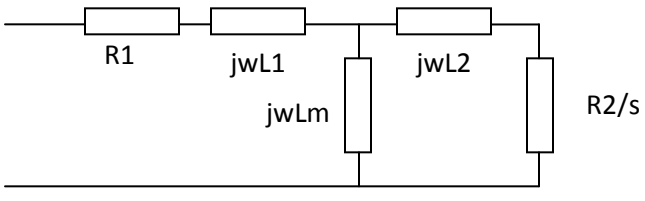
11.08 Motor Number of Poles	Range: 2-15
Default value: 4	
Displayed as : Motor poles	
Type: Uint	
Description: Motor poles are used to determine synchronous speed of induction motor. If synchronous speed is known the number of poles = $\frac{120 \text{ x Rated motor frequency(Pr 11.03)}}{\text{rated synchronous speed}}$	

11.09 Stator resistance Rs	Range: 0 – 0.5000pu
Default value: 0.0631	
Displayed as : Stator Res Rs	
Type: Uint	
Description: This is the per unit value of the stator resistance of the motor. Stator resistance value in ohms = pu value(Pr11.09)x $\frac{\text{Motor rated voltage}/\sqrt{3}}{\text{Motor rated current}}$ This parameter can be determined by auto tuning. See **14.01** & **14.02**	

11.10 Rotor resistance Rr	Range: 0 – 0.5000pu
Default value: 0.0468	
Displayed as : Rotor Res Rr	
Type: Uint	
Description: This is the per unit value of the rotor resistance of the motor. Rotor resistance value in ohms = pu value(Pr11.10)x $\frac{\text{Motor rated voltage}/\sqrt{3}}{\text{Motor rated current}}$ This parameter can be determined by auto tuning. See **14.01** & **14.02**	

11.11 Stator Inductance Ls	Range: 0.0000 - 6.5535pu
Default value: 1.6531	
Displayed as : Inductance Lm	
Type: Uint	
Description: The stator inductance (L1 + Lm) is at rated flux. This parameter can be determined by auto tuning. See **14.01** & **14.02**	

11.12 Transient Inductance σLs	Range: 0.0000 - 6.5535pu
Default value: 0.0936	
Displayed as : Leakage ind Ls	
Type: Uint	
Description: The leakage inductance or transient inductance is shown in the equivalent circuit of induction motor(jwL1). This parameter can be determined by auto tuning. See **14.01** & **14.02**	



σ **Ls = L1 + (L2.Lm / (L2 + Lm)) = Ls - (Lm^2 / Lr)**

Fig-12

11.13 Motor and Load inertia	**Range:** 0 – 65.535pu
Default value: 0.168	
Displayed as : Inertia J(pu)	
Type: Uint	
Description: This is the total motor and load inertia. It is used to set gain of speed controller in FOC mode. This parameter can be determined by auto tuning. See **14.01** & **14.02**	

Group 12 - Motor Control

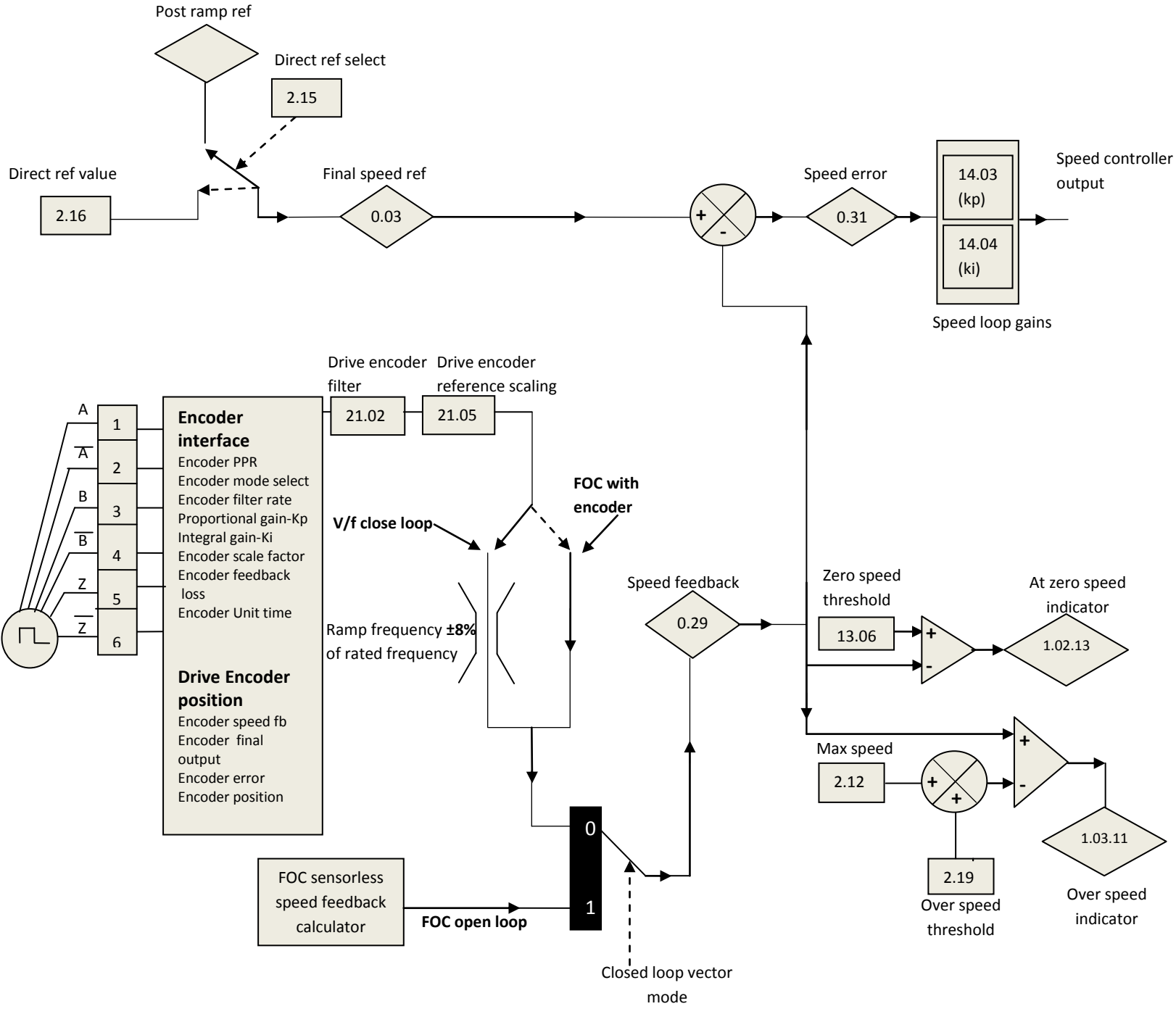


Fig-15

12.00 Motor Control Mode	Range:
Default value: V/f open loop	0: V/f open loop 1: V/f with encoder 2: FOC open loop 3: FOC with encoder
Displayed as : Motor Mode	
Type: Txt	

V/f operation: In this mode the drive maintains a constant V/f ratio over the entire frequency range. Voltage increases in the region where there is IR compensation.

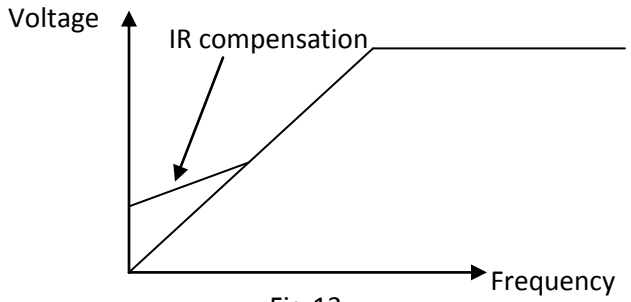


Fig-13

Field Oriented Control (FOC):

This drive implements Stator Flux Oriented Control for high performance applications.

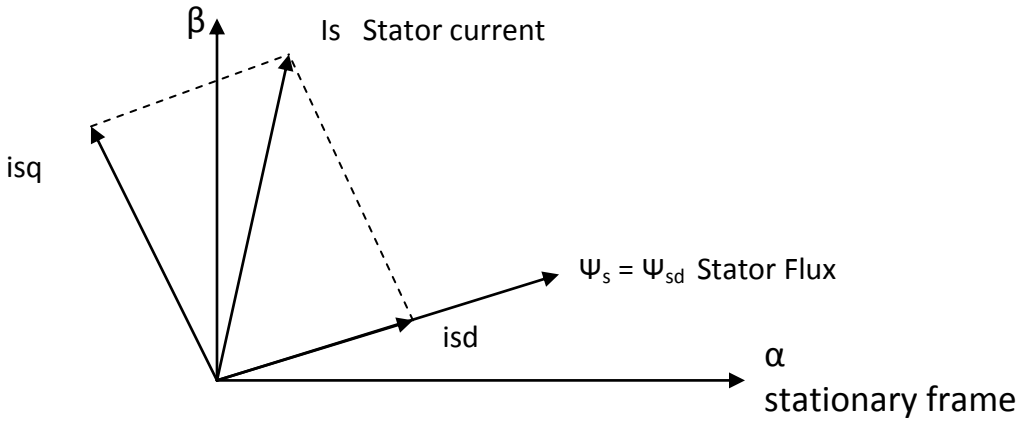


Fig-14

Accurate parameter estimation is required for this purpose.

See 14.01 & 14.02 for Auto tuning.

12.01 Switching Frequency	Range: 1 – 15Khz
Default value: 3Khz	
Displayed as : Switch Freq	
Type: Uint	
Description: This is the switching frequency of the PWM output voltage. In FOC mode, this parameter is automatically set to 3 KHz. Increasing the switching frequency results in increased switching losses in the inverter. If a switching frequency higher than 3 kHz is set and the case temperature of the IGBT exceeds 100^0C, the inverter reduces switching frequency till the case temperature falls below 100^0C.	

12.02 IR Compensation	Range: 0-50%
Default value: 0	
Displayed as : IR Compensation	
Type: Uint	
Description: Additional voltage is added to the drive output voltage at low frequency for higher output torque. This parameter is only active in V/f mode. **Warning:** If this parameter is set too high, drive could trip in OC or current limit might be activated.	

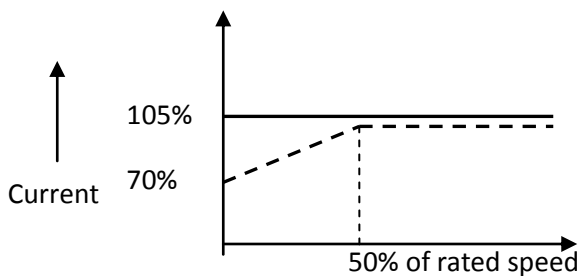
12.03 Slip Compensation	Range: 0: Disable 1: Enable
Default value: 0	
Displayed as : Slip Compensati	
Type: Txt	
Description: Slip compensation compensates for drop in speed with load. Rated slip(Hz) = $\text{Rated frequency (Pr11.03)} - \frac{\text{No of poles(Pr11.08) x Rated speed of motor(Pr11.04)}}{120}$ **Note:** For higher speed compensation, rated speed of the motor can be reduced.	

Reserved: 12.05 – 12.08

12.09 Current Limit	Range: 0 – 300%
Default value: 1. 110% of rated current if rated current > heavy duty current OR 2. 175% of rated current in FOC mode. Rated current <= heavy duty current OR 3. 150% of rated current in V/f mode. Rated current <= heavy duty current.	
Displayed as : Current Limit	
Type: Uint	
Description: Current limit when activated: **1.** Reduces post ramp ref or prevents acceleration if drive is accelerating. **2.** Holds or increases post ramp ref if drive is decelerating.	

12.16 Thermal Protection Curve	Range: 0: 1st curve select 1: 2nd curve select
Default value: Continuous	
Displayed as : Thermal Prt curv	
Type: Txt	

Description: 2 types of curves can be selected for motor thermal protection. Based on rated current **Pr11.01** these curves are shown below.



Heavy duty
Based on Motor rated current
Pr11.01

Fig-16

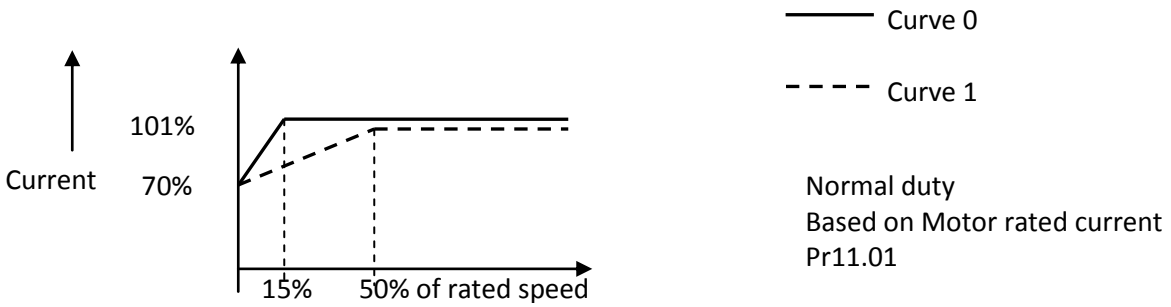


Fig-17

Note: Ref to Hardware manual for heavy duty and normal duty ratings.

Motor Thermal Protection:

Motor temperature is estimated by the equation:

$$\text{Estimated motor temperature \%} = \frac{I^2}{\text{Motor rated current}^2}\left(1 - e^{-t/\tau}\right) \text{x } 100\%$$

I : Drive output current

τ : Thermal time constant **Pr12.17**

Drive trips when estimated temperature is greater than 100%.

In both curves, motor rated current reduces below 50% rated speed or 15% rated speed. This reduction is used for thermal calculation only. The default thermal time constant is 89s for which 150% overload is possible for 60s from cold start. Motor temperature is continuously estimated in run condition. It is reset to zero on power up.

12.18 Energy Saving Mode	**Range:** 0: Disable 1: Enable
Default value: Enable	
Displayed as : Energy saving md	
Type: Txt	
Description: This mode can be used to save energy if motor is lightly loaded. Motor output voltage is reduced if load current is less that 70% of rated motor current.	

12.19 Mains loss sensing level	**Range:** 0-600
Default value: 450	
Displayed as : Mains Loss Level	
Type: Uint	
Description: A mains loss condition is detected if DC bus voltage falls below this level. Minimum value of this parameter is the default value. If set below the default value, the default value is the loss detection level.	

Group 13 - V/f Control

13.00 V/f Curve	Range: 0: Linear 1: Quadratic 2: User
Default value: Linear	
Displayed as : V/f Curve	
Type: Txt	

Description: In the linear mode, a V/f slope calculated at motor rated voltage (**Pr11.02**) and motor rated frequency-(**Pr11.03**) is applied. A minimum voltage of 5V is set at 0.5Hz. In the quadratic mode a motor voltage proportional to the square of the frequency is applied. This curve is suitable for fan and pump loads. This curve is not suitable for constant torque loads or loads which require a high starting torque. A voltage boost can be applied in both modes using IR compensation (**Pr12.02**).

A user defined V/f curve can be applied as shown:

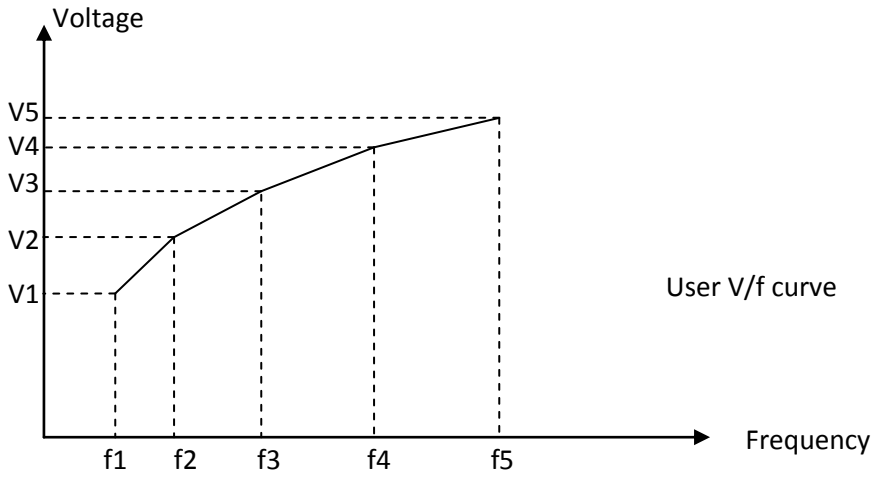


Fig-19

Set: f5 > f4 > f3 > f2 > f1
V5 > V4 > V3 > V2 > V1

13.01 V/f Voltage 1 13.02 V/f Voltage 2 13.03 V/f Voltage 3 13.04 V/f Voltage 4 13.05 V/f Voltage 5	Range: 0 – 1000V
Default value: V/f Volt1: 5V V/f Volt2: 83V V/f Volt3: 208V V/f Volt4: 332V V/f Volt5: 415V	
Displayed as : V/f Volt	
Type: Uint	

13.06 V/f Frequency 1 **13.07 V/f Frequency 2** **13.08 V/f Frequency 3** **13.09 V/f Frequency 4** **13.10 V/f Frequency 5**	**Range:** 0 – 500.0 Hz
Default value: V/f Freq1: 0.5 Hz V/f Freq2: 10.0 Hz V/f Freq3: 25.0 Hz V/f Freq4: 40.0 Hz V/f Freq5: 50.0 Hz	
Displayed as : V/f Freq	
Type: Uint	

Group 14 - FOC Control

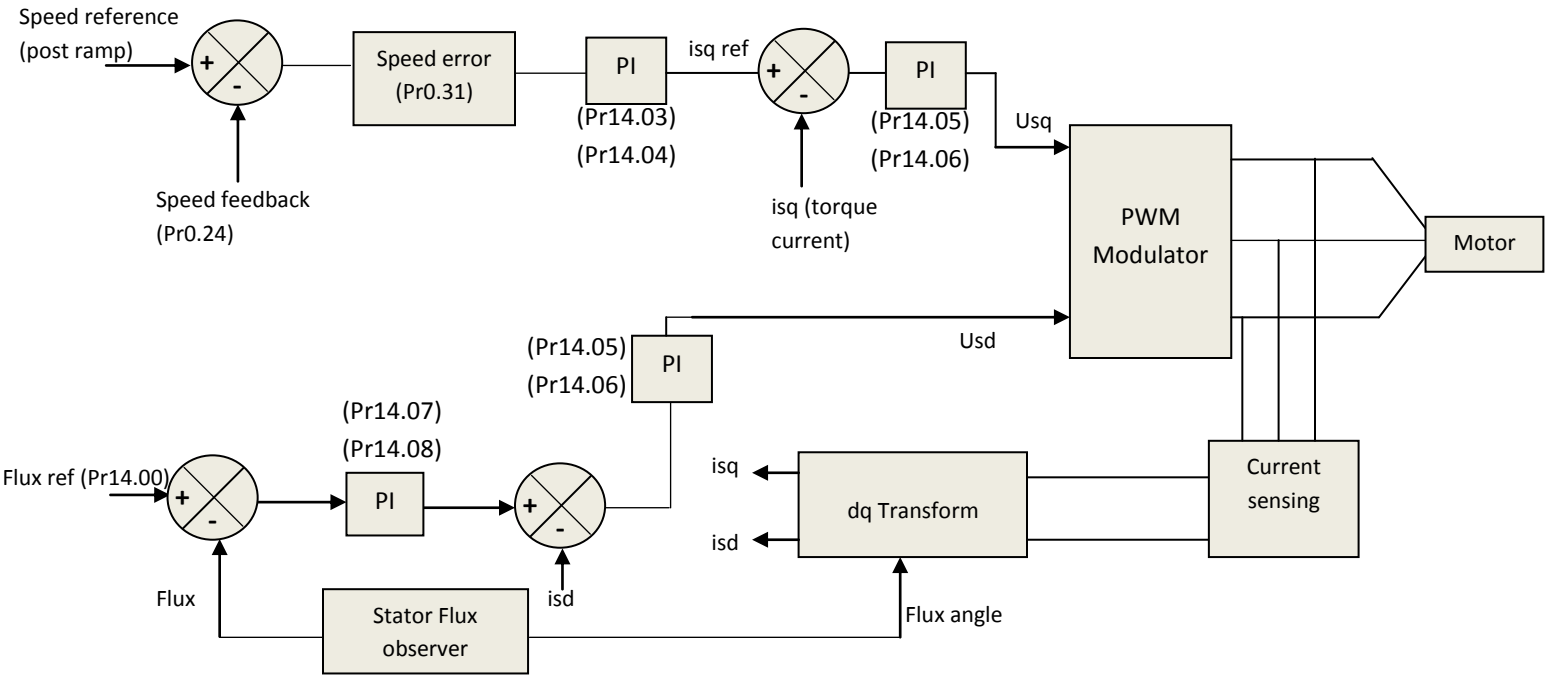


Fig-20

14.00 Flux Reference	
Default value: 100%	**Range:** 0 – 120%
Displayed as : Flux Ref	
Type: Uint	
Description: This is the flux reference for flux loop in field oriented control (FOC) mode (**Pr12.00**). It is advisable to keep this value unchanged (at default value).	

14.01 Motor Parameter Estimation	**Range:** 0: Off 1: Estimation with motor shaft rotation 2: Estimation at stand still
Default value: Off	
Displayed as : Motor Para est	
Type: Txt	

Description: Before running the motor in FOC mode, motor parameters have to be accurately estimated.
Parameter estimation can be done with a motor shaft rotation or at stand still. However estimation with rotating motor shaft is more accurate. Motor shaft should be uncoupled from load for this purpose. If it is not possible to uncouple motor shaft from load, estimation at stand still can be used for parameter estimation.
After setting the parameter estimation method, a run command is given. If estimation with shaft rotation is selected, motor will run briefly at rated speed. This parameter is automatically reset on completion of estimation, so that the next run command is a normal start operation. This parameter is always 'Off' on power up i.e its value is not stored in e2prom.
Motor parameters saved in e2prom after this test:

1. Stator resistance Rs **Pr11.09**
2. Rotor resistance Rr **Pr11.10**
3. Stator inductance Ls **Pr11.11**

4. Transient inductance σLs **Pr11.12** 5. Current controller PI loop gains **Pr14.05,Pr14.06,Pr14.07,Pr14.08**

14.02 Inertia Estimation	**Range:** 0: Disable 1: Enable
Default value: Disable	
Displayed as : Inertia Estimate	
Type: Uint	
Description: Inertia estimation of motor and load is required for setting speed loop gains in FOC mode. Enable parameter estimation and give run command for inertia estimation. The speed loop PI gains are automatically updated. Motor accelerates to 25Hz (in case of a 50hz motor) and then decelerates to stop. The speed loop parameters **Pr14.03, Pr14.04** and inertia **Pr11.13** are updated and stored in e2prom.	

14.03 Speed Controller proportional gain Kp	**Range:** 0 - 655.35
Default value: 11.42	
Displayed as : Spd ctr gain kp	
Type: Uint	
Description: In FOC mode, speed controller gain Kp is updated after inertia estimation. A user value can also be set. **Note:** If a user value is set, care should be taken to avoid speed loop instability. A too high or too low value could cause speed loop instability.	

14.04 Speed Controller integral gain Ki	**Range:** 0 – 65.535
Default value: 0.042	
Displayed as : Spd ctr gain ki	
Type: Uint	
Description: In FOC mode, speed controller gain Ki is updated after inertia estimation. A user value can also be set. Note: If a user value is set, care should be taken to avoid speed loop instability. A too high or too low value could cause speed loop instability.	

***Note**: Although Current controller and Flux controller PI gains are available for setup, these parameters are not required to be setup in most applications*

14.05 Current Controller proportional gain Kp	**Range:** 0 – 65.535
Default value: 0.199	
Displayed as : Cu ctr gain kp	
Type: Uint	
Description: This parameter is automatically set after motor parameter estimation (**Pr14.01**). If motor rated power (**Pr11.05**) or motor rated current (**Pr11.01**) is changed, this parameter value changes.	

14.06 Current Controller proportional gain Ki	**Range:** 0 – 6.5535
Default value: 0.0240	
Displayed as : Cu ctr gain ki	
Type: Uint	
Description: This parameter is automatically set after motor parameter estimation (**Pr14.01**). If motor rated power (**Pr11.05**) or motor rated current (**Pr11.01**) is changed, this parameter value changes.	

14.07 Flux Controller proportional gain Kp	**Range:** 0 – 65.535
Default value: 0.130	

Displayed as : Flux ctr gain kp	
Type: Uint	
Description: This parameter is automatically set after motor parameter estimation (**Pr14.01**). If motor rated power(**Pr11.05**) or motor rated current(**Pr11.01**) is changed, this parameter value changes.	

14.08 Flux Controller integral gain Ki	**Range:** 0 – 6.5535
Default value: 0.006	
Displayed as : Flux ctr gain ki	
Type: Uint	
Description: This parameter is automatically set after motor parameter estimation (**Pr14.01**). If motor rated power(**Pr11.05**) or motor rated current(**Pr11.01**) is changed, this parameter value changes.	

P14.09, P14.10, P14.11 ------ To be disclosed

Group 15 - Preset Speeds

15.00 Preset Speed 1 **15.01 Preset Speed 2** **15.03 Preset Speed 3** **15.04 Preset Speed 4** **15.05 Preset Speed 5** **15.06 Preset Speed 6** **15.07 Preset Speed 7**	
Default value: Preset Speed1 200rpm Preset Speed2 400rpm Preset Speed3 600rpm Preset Speed4 800rpm Preset Speed5 1000rpm Preset Speed6 1200rpm Preset Speed7 1400rpm	**Range:** -30000 to 30000 rpm
Displayed as : Preset Speed	
Type: Int	

Description: A preset speed when selected bypasses the drive frequency reference. Any user terminal from DIO1-In7 can be configured for preset speed input. The following preset speeds can be configured:

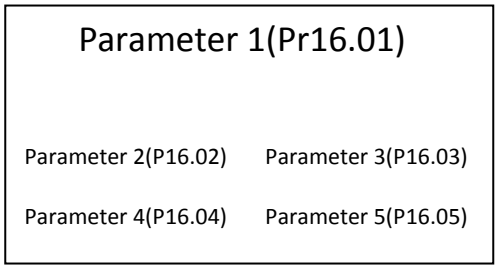
Preset Speed 1 **Pr5.24**	**Preset Speed 2** **Pr5.26**	**Preset Speed 3** **Pr5.28**	**Drive frequency ref**
0	0	0	No preset speed selected
0	0	1	Preset speed 1
0	1	0	Preset speed 2
0	1	1	Preset speed 3
1	0	0	Preset speed 4
1	0	1	Preset speed 5
1	1	0	Preset speed 6
1	1	1	Preset speed 7

Group 16 - OLED Display and User Parameters

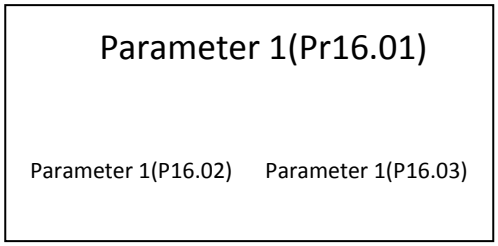
16.00 Frame Selection	Range: 0: Frame 1 1: Frame 2
Default value: Frame 1	
Displayed as : Frame selection	
Type: Txt	

Description: Two types of display frames can be selected on the OLED display. Parameters can be selected from **Group0** and **Group1** for display.

Frame 1: 5 parameters can be displayed on this frame.



Frame 2: 3 Parameters can be displayed on this frame.



16.01 Parameter 1 select 16.02 Parameter 2 select 16.03 Parameter 3 select 16.04 Parameter 4 select 16.05 Parameter 5 select	Range: Value Pointer
Default value: Signal 1 Select P.00.00 Signal 2 Select P.00.03 Signal 3 Select P.00.07 Signal 4 Select P.00.09 Signal 5 Select P.00.23	
Displayed as : Signal1 Select, Signal2 Select, Signal3 Select, Signal 4 Select, Signal 5 Select	
Type: Value Pointer	

Description: These parameters select 5 display fields as shown in **Pr16.00**. Value pointer can be set to point to any parameter in **Group0** and **Group1**.

16.06 Time Display on/off	Range: 0: On 1: Off
Default value: On	
Displayed as : Time Display	
Type: Txt	

Description: If set to 'On' current time is displayed on upper right corner of the OLED display. Control board with battery option has to be selected for this purpose. Without on board battery , time displayed on power up is 00:00.

16.07 User Value Pointer	Range: Value Pointer
Default value: P.00.03	
Displayed as : User value Ptr	
Type: Value Pointer	
Description: A user value is calculated as follows: **User value= User value pointer x Slope + Constant** **Slope = (Pr16.10 – Pr16.11)/(Pr16.08 – Pr16.09)** **Constant = Pr16.10 – Slope x Pr16.08** This value can be used for arbitrary frequency ref slope generation based on input values.	

16.08 User maximum reference value 16.09 User minimum reference value 16.10 User out maximum reference 16.11 User out minimum reference	Range: -320.00 to 320.00
Default value: +50 , 0 , +50 , 0	
Displayed as : user ref max, user ref min, user out max, user out min	
Type: Int	

Group 17 – Modbus & DDI

17.00 DDI interface	Range:
Default value: Disable	0: Disable 1: DDI 2: Modbus
Displayed as : Interface sel	
Type: Txt	
Description: This is the **drive to drive** RS485 Modbus interface. It can also be used to communicate with external devices. End point terminations can be provided using jumpers (ref to hardware manual – jumper settings).	

17.01 Master Slave select	Range:
Default value: Slave	0: Master 1: Slave
Displayed as : Master Slave sel	
Type: Txt	
Description: Set the drive as a modbus master or slave.	

17.02 Slave address	Range: 1-247
Default value: 1	
Displayed as : Slave address	
Type: Uint	

17.03 Baud rate	Range:
Default value: 9600	0: 4800 1: 9600 2: 19200 3: 38400
Displayed as : Baud rate	
Type: Uint	

17.04 Error response	Range:
Default value: Error Displayed	0: No response 1: Display error 2: Display error and stop
Displayed as : Error response	
Type: Txt	

Description: 'Display error and stop' option can be used to determine integrity of RS485 network. Error messages:

1. Illegal Function
2. Illegal Data address
3. Illegal Data value
4. Slave device failure
5. Checksum error
6. Invalid message
7. Not an ascii value
8. Parity error
9. Framing error
10. Over run error

17.05 Modbus Protocol	Range:
Default value: RTU, 8 bit, No Parity, 2 stop bits	0: ASCII, 7bit, even parity, 1 stop bit 1: ASCII, 7bit, odd parity, 1 stop bit 2: RTU, 8bit, No parity, 2 stop bits 3: RTU, 8bit, Even parity, 1 stop bit 4: RTU, 8bit, odd parity, 1 stop bit
Displayed as : Modbus Protocol	
Type: Txt	

17.06 Frame select	Range: Value Pointer
Default value: P.17.13	
Displayed as : Frame1 select	
Type: Value pointer	

Description: When selected as master(**Pr17.01**) following frames are transmitted:
1. Frame (which is a value pointer in this parameter) is transmitted to addresses **Pr17.07 to Pr17.10**
2. Frame (which is a value pointer) is broadcast (**Pr17.11**)
In all, 2 frames can be transmitted to slave addresses 1 to 32 i.e 32 possible slave devices.
In either of the above mentioned frames a user command **Pr17.13** can be transmitted.

17.07 Frame address1 **17.08 Frame address 2** **17.09 Frame address 3** **17.10 Frame address 4**	**Range:** 00000000b - 11111111b
Default value: 0	
Displayed as : Frame1 add	
Type: Bit Word	

Description: If configured as Modbus master(**Pr17.06**), slave addresses can be configured using these parameters.
Slave address range: 1 to 32.

Frame address 1 ---- slave addresses 1 to 8
Frame address 2 ---- slave addresses 9 to 16
Frame address 3 ---- slave addresses 17 to 24
Frame address 4 ---- slave addresses 25 to 32

For E.g.: To send data to slave 8 and 22 only set :

P17.07 = 10000000b
P17.08 = 00000000b
P17.09 = 00100000b
P17.10 = 00000000b

17.11 Frame Broadcast	**Range:** Value pointer
Default value: P.00.00	
Displayed as : Frame Broadcast	
Type: Value pointer	
Description: Ref to **Pr17.06. Note:** If set to P.50.00 frame broadcast is disabled.	

17.12 Frame transmission interval	**Range:** 0.050s – 10.000s
Default value: 0.250s	
Displayed as : Master trans int	
Type: Uint	
Description: This is the interval between successive frame transmissions. A broadcast frame is transmitted first followed by the frame in **Pr17.06**.	

17.13 User command register	**Range:** 00000000b – 11111111b
Default value: 0	
Displayed as : User command sel	
Type: Bit Word	

Description: If drive is set as a master(**Pr17.01**), a command frame shown below can be transmitted to slave devices. This frame can be sent to definite slave addresses using (**Pr17.06**) or broadcast using (**Pr17.11**).
Eg: if Pr17.06 = P.17.13, command frame shown below is transmitted to slave devices selected in **Pr17.07** to **Pr17.10**
If Pr17.11 = P.17.13, command frame shown below is broadcast.

x	Preset speed 3	Preset speed 2	Preset speed 1	Trip reset	REV	FWD	Stop	RUN

Bit8 Bit0 Active: 1

User command register

If drive is configured as a slave, master device can write commands to the user command register.
Eg: For start/stop and FWD/REV using DDI mode, set **Pr4.06** or **Pr4.13** = DDI1.
To start drive(of say slave address 01) , master device issues a frame 01,06,**11,0D**,00,01,CR,LF
To stop drive, command issued : 01,06,**11,0D**,00,02,CR,LF
To change Set frequency, set Pr2.00 = DDI reference1
If Required Set frequency = 25.0Hz, master device issues a frame 01,06,**00,32**,**00,FA**,CR,LF
If Required Set frequency = 50.0Hz, master device issues a frame 01,06,**00,32**,**01,F4**,CR,LF

Other modbus examples in RTU mode:
Function write for int16 and Uint16 parameters, slave address 01, parameter: Pr15.01 = 1200,
Frame: 01,06,**0F,01,**04,B0,28,36
Function read for int16 and Uint16 parameters, slave address, 01, parameter:Pr00.03,
Frame: 01,03,**00,33**,**MSB of data, LSB of data**,CR,LF

Function write for int32 and Uint32 parameters, slave address 01, parameter: Pr3.00 = 80.000,
Frame: 01,10,**03,00,**00,02,04,**00,01,38,80,**CR,LF
Function read for int32 and Uint32 parameter, slave address 01, parameter: Pr3.02,
Frame: 01,10,**03,02,**00,02,04,**XX,YY,AA,BB,**CR,LF
XX,YY is MSB of 32bit data and AA,BB is LSB of 32bit data

Other modbus examples in ASCII mode:
Function write for int16 and Uint16 parameter, slave address 01, parameter: Pr15.01 = 1200,
Frame: **:**0106**0F0104B0**checksum
Function read for int16 and Uint16 parameter, slave address, 01, parameter = Pr00.03,
Frame: **:**0103**0003XXYY**checksum, XX is MSB of data and YY is LSB of data
Function write for int32 and Uint32 parameter, slave address 01, parameter: Pr3.00 = 10.000,
Frame: **:**0110**0300**000204**00013880**checksum
Function read for int32 and Uint32 parameter, slave address 01, parameter: Pr3.02,
Frame: **:**0110**0302**000204**XXYYAABB**checksum
XX,YY is MSB of 32bit data and AA,BB is LSB of 32bit data

Group 18 – Timers

18.00 Timer mode	Range:
Default value: Normal mode	0: Normal mode 1: Single cycle mode 2: Continuous cycle mode
Displayed as : Timer mode	
Type: Txt	

Description: 8 timers are available with individual control bits. The control bit is a bit pointer. Each timer is activated by setting control bit to '1'. Timer status is available in 'Timer Status Bits' **Pr1.01.**

Timer7	Timer6	Timer5	Timer4	Timer3	Timer2	Timer1	Timer0

0: Timer inactive or counting up
1: Timer value achieved.

Normal mode (One shot mode):

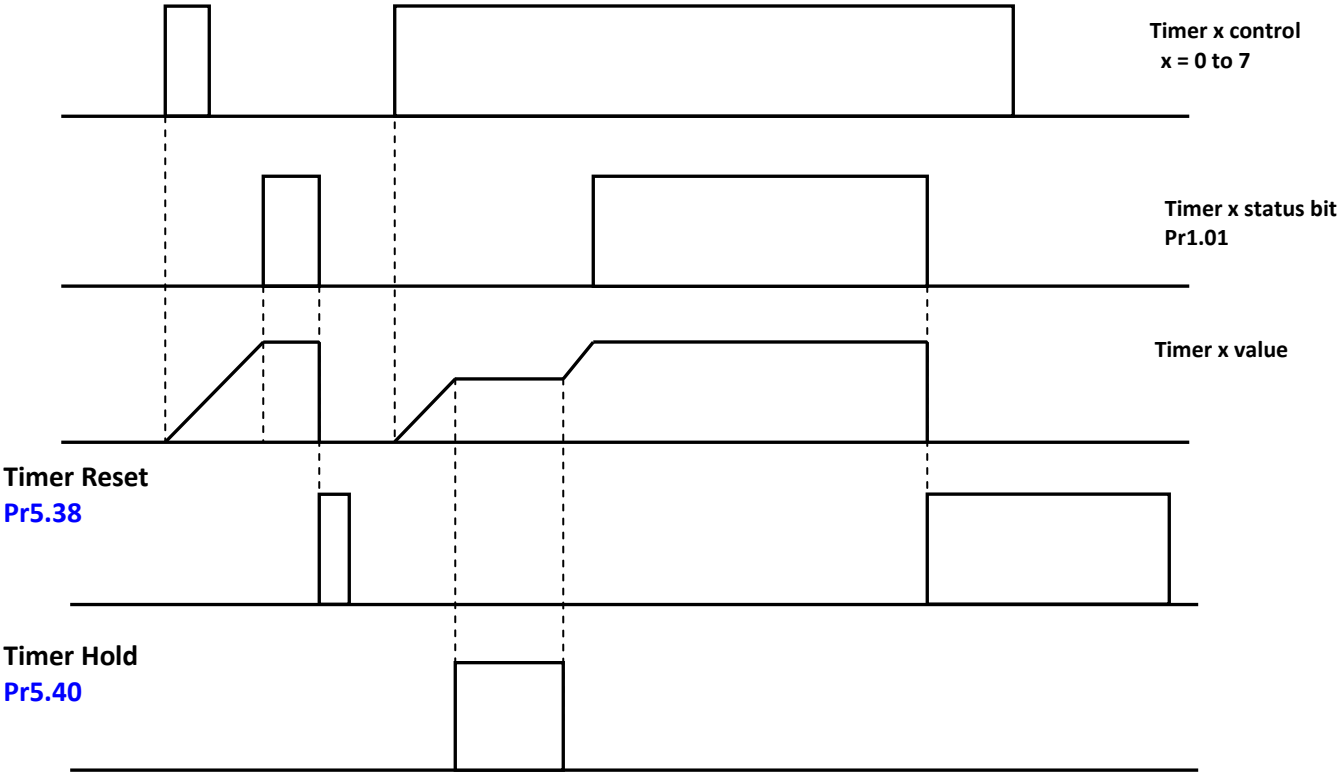
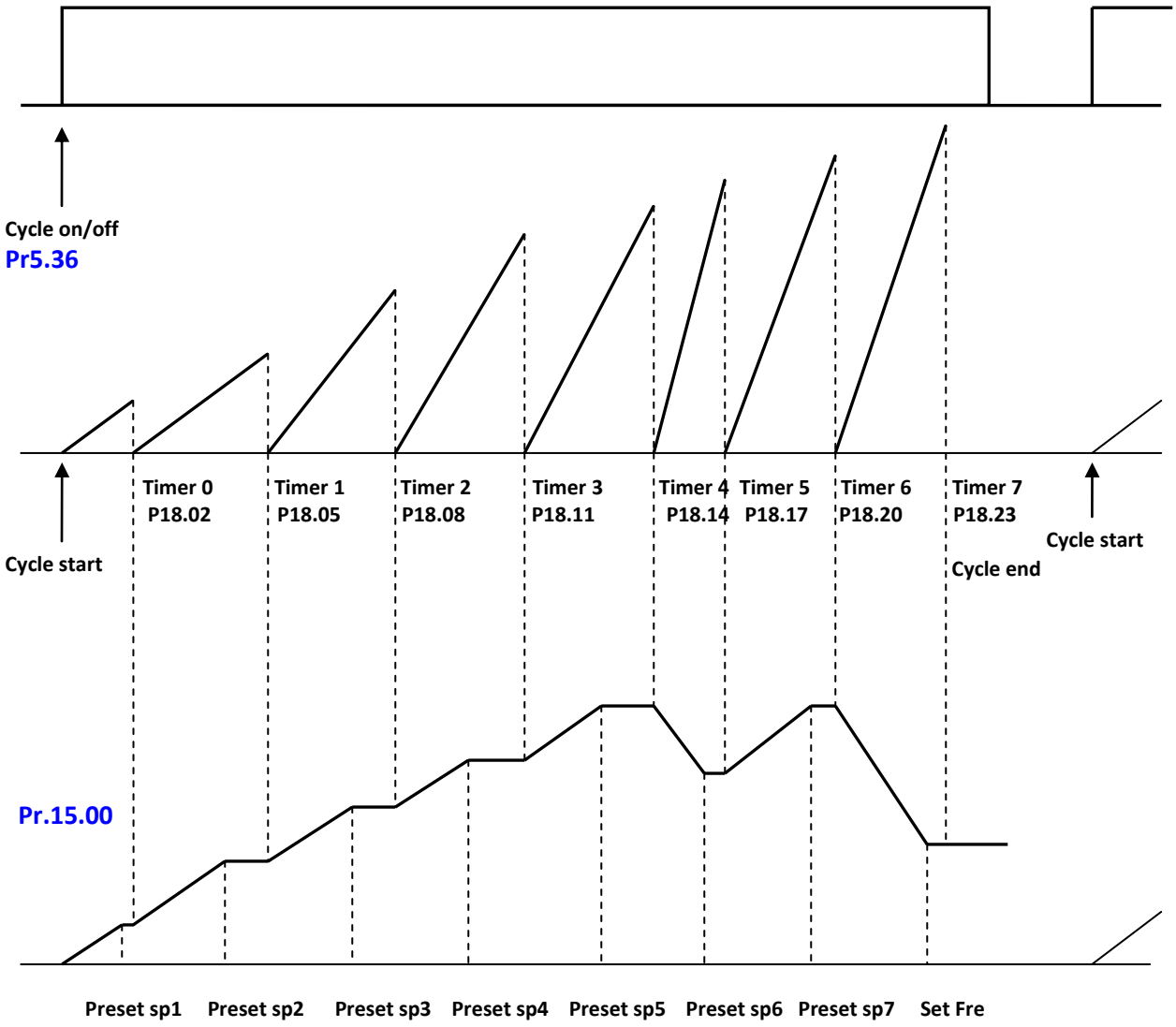


Fig-21

One shot mode can be used for one time timer events as shown above.

Single cycle mode:
This mode is activated by parameter **Timer cycle on/off (Pr5.36).**
Cycle is reset and all timers are reset if cycle on/off signal becomes 0 while cycle is in progress.
Parameter **Timer hold** (Pr5.40) can be used to pause cycle mode. Timer status bit of each timer is set when timer value is achieved.



Drive output frequency accelerates/decelerates to preset speed

Fig-22

Continuous cycle mode: This is similar to single cycle mode except that a new cycle begins after completion of the previous one. Cycle on/off signal should remain continuously **on** in this mode.

Group 19 - System Parameters

P19.00, P19.04, P19.08: reserved parameters

19.05 E2PROM default	Range: 0: No 1: Yes
Default value: No	
Displayed as : E2prom default	
Type: Txt	
Description: E2PROM parameters can be set to factory default value using this parameter. If motor ratings are different from the default parameter settings, these have to be set after restoring default values. An 'E2prom error' message is displayed if any of the drive parameters are not within range.	

19.06 User Password	Range: 0 - 9999
Default value: 0	
Displayed as : User Password	
Type: Uint	
Description: If user password Is 0 all drive parameters can be modified. In case of a non-zero value, user password that is entered should match the parameter 'Set User Password' **Pr19.07**. User password is not saved in E2PROM.	

19.07 Set User Password	Range: 0 - 9999
Default value: 0	
Displayed as : Usr Password set	
Type: Uint	
Description: When attempting to set this parameter, 'Enter old password' is displayed. Upon entering the old password a new user password change is allowed. When set to default (**Pr19.05**), parameter **User password Pr19.06** is 0.	

19.09 Energy reset	Range: 0: No 1: Yes
Default value: 0	
Displayed as : Energy Reset	
Type: Txt	
Description: Energy value stored in **Pr0.12** and **Pr0.13** is reset to zero. This value is also reset when E2prom default settings are activated **Pr19.05**.	

19.10 Time set 19.11 Date set 19.12 Year set	Range: **19.10** 000-23.59 **19.11** 1.01 to 31.12 **19.12** 2000-9999
Default value: **19.10** 00:00 **19.11** 1.01 **19.12** 2013	
Displayed as : Energy Rst	
Type: Txt	
Description: These are the settings for time (24 hr format), date (dd:mm) and year. An optional battery on control board is required to display correct values. Without a battery, drive will always display a time value 00:00 on power up.	

Group 21 – Encoder

21.00 Encoder PPR	
Default value: 1024	**Range:** 256 – 50000
Displayed as : Encoder PPR	
Type: Uint	
Description: Encoder pulses per revolutions for quadrature incremental encoders are set in this parameter.	

21.01 Encoder mode select	**Range:**
Default value: QEPA rising and falling edge	0: QEP – AB rising and falling edge select 1: QEP A rising and falling edge select 2: QEP A rising edge select
Displayed as : Encoder mode sel	
Type: Txt	

21.02 Encoder filter rate	
Default value: 0.010s	**Range:** 0 – 5.000s
Displayed as : Encoder flt rate	
Type: Uint	

21.03 Proportional gain-Kp 21.04 Integral gain-Ki	**Range:** **21.03**: 0 – 6.5535 **21.04**: 0 – 6.5535
Default value: **21.03** 0.0200 **21.04** 0.0100	
Displayed as : Proprtnl gain-Kp Integral gain-Ki	
Type: Uint	
Description: These are the speed loop PI gains if drive is configured for closed loop V/f mode (**Pr12.00**). **Note:** These parameters are not used in FOC mode.	

21.05 Encoder scale factor	
Default value: 1.000	**Range:** 0 – 30.000
Displayed as : Enc Ref scale	
Type: Uint	
Description: Encoder output can be scaled using this parameter. A scaled value is then used in the speed loop.	

21.06 Encoder feedback loss	**Range:** 0: No action 1: Trip 2: Alarm
Default value: Alarm	
Displayed as : Encoder f/b loss	
Type: Txt	
Description: An encoder feedback loss is detected on loss of connection or absence of encoder pulses.	

Group 22 - Macros

On enabling a macro pre set values of parameters are loaded for a definite function. This makes it easy to realize a commonly used configuration. The load option loads macro parameters one time. These values are lost on power off. With the store option, the macro parameters are stored in e2prom.

22.00 3 wire macro	Range:
Default value: Disable	0: Disable 1: Load parameter 2: Store parameter
Displayed as : MC1-3 wire mode	
Type: Uint	

Description: With this macro, drive is:

1. Configured in 3 wire mode for start/stop
2. Jog, motorized pot up and down, Rev is enabled.
3. Jog ref is set.
4. Frequency ref1 (0-10V) is set to Analog input 1 and frequency ref 2 is set to motorized pot.
5. DI5 is configured for frequency ref1/ref2 selection.

Parameter set by this macro:

P2.00 Frequency reference 1 = Analog input1
P2.02 Frequency reference 2 = Analog inp3 ref
P2.07 Jog ref = 150rpm
P4.00 Run1 = DI5
P4.02 Stop1 = DIO3
P4.04 Rev1 = constant: 0
P4.06 External start/stop mode1 = 3wire
P5.16 Speed ref1/ref2 select = constant: 0
P5.18 Mot pot up = DI4
P5.20 Mot pot down = DI6
P9.00 Analog input1 filter time = 0.1s
P9.01 Analog input1 max = 10.000V
P9.02 Analog intput1 min = 0V
P9.03 Ref at max analog inp = 50.0Hz
P9.05 Ref at min analog inp = 0.5Hz

22.01 Preset speed macro	Range:
Default value: Disable	0: Disable 1: Load parameter 2: Store parameter
Displayed as : MC2-Preset Speed	
Type: Txt	

Description: With this macro, drive is configured for:

1. 3 wire mode.

2. 3 Preset speeds

3. Continuous cyclic mode

Parameter set by this macro:

P4.00 Run1 = DI5

P4.02 Stop1 = DIO3

P4.04 Rev1 = constant: 0

P4.06 External start/stop mode1 = 3wire

P5.24 Preset speed1 = constant: 0

P5.26 Preset speed 2 = constant: 0

P5.28 Preset speed 3 = constant: 0

P5.36 Timer cycle on/off = constant: 0

P18.00 Timer mode = Normal mode

Group 23 – Supervision

23.00 Supervisor Function 1 **23.06 Supervisor Function 2** **23.12 Supervisor Function 3**	**Range:** 0: Disable 1: Below Min ref 2: Above Max ref 3: Between Min and Max ref
Default value: Disable	
Displayed as : Superv1 function, Superv2 function, Superv3 function	
Type: Txt	

Description: A supervisory function can be used to monitor any drive parameter. The selected parameter for supervision can be selected by a value pointer.

Value pointer for supervisor function 1 ------ **Pr23.01**
Value pointer for supervisor function 2 ------ **Pr23.07**
Value pointer for supervisor function 3 ------ **Pr23.13**

The maximum and minimum references can be set by parameters as follows:

Max and Min ref for supervisor function 1 ---- **Pr23.02** and **Pr23.04**
Max and Min ref for supervisor function 2 ---- **Pr23.08** and **Pr23.10**
Max and Min ref for supervisor function 3 ---- **Pr23.14** and **Pr23.16**

Output of supervisor function available as a status bit:

Supervisor Function1 ---- **1.03.00**
Supervisor Function2 ---- **1.03.01**
Supervisor Function3 ---- **1.03.02**

23.01 Supervisor1 signal **23.07 Supervisor2 signal** **23.13 Supervisor3 signal**	**Range:** Value Pointer
Default value: P.00.00.00	
Displayed as : Superv1 signal, Superv2 signal, Superv3 signal	
Type: Value pointer	

23.02 Supervisor1 Max ref **23.08 Supervisor2 Max ref** **23.14 Supervisor3 Max ref**	**Range:** -32768.000 to 32768.000
Default value: 50.000	
Displayed as : Superv1 max ref, Superv2 max ref, Superv3 max ref	
Type: Int32	

23.04 Supervisor1 Min ref **23.10 Supervisor2 Min ref** **23.16 Supervisor3 Min ref**	**Range:** -32768.000 to 32768.000
Default value: 0	
Displayed as : Superv1 min ref, Superv2 min ref, Superv3 min ref	
Type: Int32	

Group 24 - Skip Frequency

Certain frequency ranges can be avoided with skip frequency function.

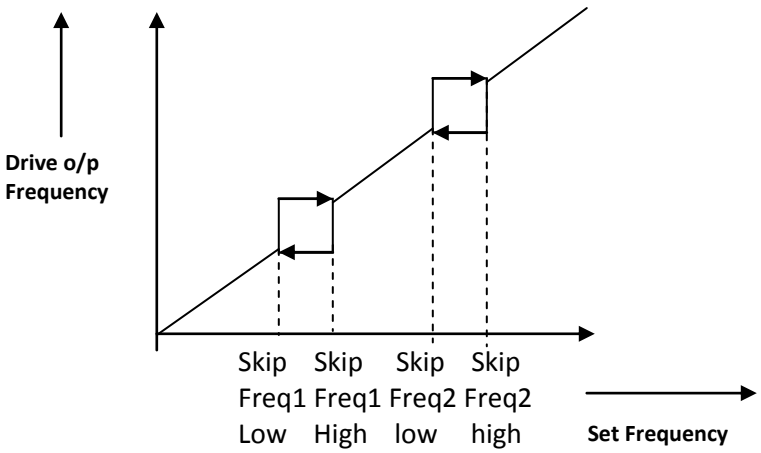


Fig-23

24.00 Skip Frequency select	**Range:** 0: Disable 1: Enable
Default value: Disable	
Displayed as : Skip freq sel	
Type: Txt	

24.01 Skip Frequency 1 Low **24.02 Skip Frequency 1 High** **24.03 Skip Frequency 2 Low** **24.04 Skip Frequency 2 High** **24.05 Skip Frequency 3 Low** **24.06 Skip Frequency 3 High**	**Range:** 0 – 30000rpm
Default value: 0	
Displayed as: Skip freq1 low, Skip freq1 high, Skip freq2 low, Skip freq2 high, Skip freq3 low, Skip freq3 high.	
Type: Uint	
Description: Frequencies between skip frequency high and skip frequency low are bypassed. 3 such bands are available. Ensure that : **Skip Frequency1 high > Skip Frequency1 Low** **Skip Frequency2 high > Skip Frequency2 Low** **Skip Frequency3 high > Skip Frequency3 Low**	

Group 25 – Fault Auto Reset

25.00 Auto Fault Reset	Range: 00000000b – 11111111b
Default value: 00000000b	
Displayed as : Auto Fault bit	
Type: Bit Word	

Description:
Drive faults can be configured for auto reset as shown below:

x	PL	EF	OS	OT	OC	OV	UV
Bit8							**Bit0**

PL: Phase loss
EF: External Fault
OS: Over speed
OT: Over temperature
OC: Over Current
OV: DC Bus Over Voltage
UV: DC Bus Under Voltage

To configure an auto reset, set bit corresponding to the fault to 1.
For E.g.: To configure auto reset for over current trip set value = 00000100

25.01 Number of attempts	Range: 0 - 5
Default value: 3	
Displayed as : No. of retries	
Type: Uint	

25.02 Time between attempts	Range: 0 – 150.0s
Default value: 10.0s	
Displayed as : Time btw retries	
Type: Uint	
Description: This is the time duration between successive auto reset attempts.	

25.03 Auto Reset Time	Range: 1.0 – 600.0s
Default value: 10.0s	
Displayed as : Trial Time	
Type: Uint	
Description: This is the time duration for auto reset attempts. **For E.g.:** If this time duration is set to 5min , and 2 faults occurs within 5 minutes and the third one occurs after 10min then a new auto reset interval starts for the third fault. This fault reset is now the first attempt in the new interval.	

Group 26 - PID Control

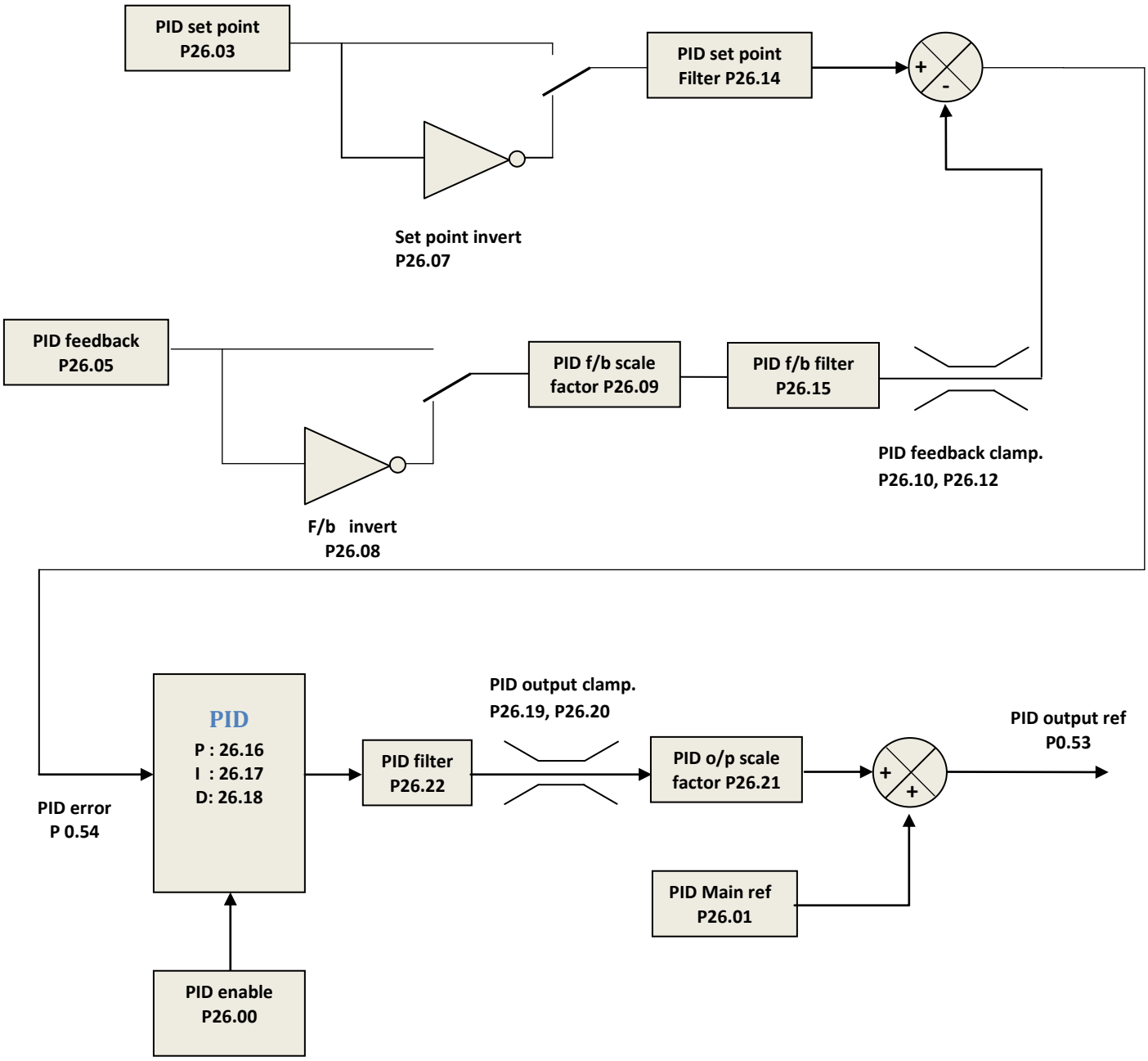


Fig-24

The process set point is connected to the drive. The feedback is also connected to the drive. The output of the PID controller can be used as a speed ref or it can be added to the drive speed reference (**Pr26.01**).

26.00 PID	Range:
Default value: Disable	0: Disable 1: Enable
Displayed as : PID	
Type: Txt	

26.01 Main Ref source	Range:
Default value: Zero ref	0: Zero ref 1: Analog input 1 2: Analog input 2 3: Analog input 3 4: D2D reference1 5: D2D reference2 6: Val Pointer
Displayed as : Disable	
Type: Txt + Val Ptr	
Description: PID output is added to this parameter.	

26.03 PID set point	Range:
Default value: Analog input 2	0: Zero ref 1: Analog input 1 2: Analog input 2 3: Analog input 3 4: D2D reference1 5: D2D reference2 6: Val Pointer
Displayed as : PID st pt	
Type: Txt + Val Ptr	

26.05 PID feedback source	Range:
Default value: Analog input 3	0: Zero ref 1: Analog input 1 2: Analog input 2 3: Analog input 3 4: D2D reference1 5: D2D reference2 6: Val Pointer
Displayed as : PID fb sr	
Type: Txt + Val Ptr	

26.07 PID set point invert 26.08 PID source invert	Range:
Default value: Non inverting	0: Non inverting 1: Inverting
Displayed as : PID sp inv PID sr inv	
Type: Txt	

26.09 PID feedback scale factor 26.21 PID output scale factor	Range:
Default value: 1.000	-30.000 to 30.000
Displayed as : PID fb sc PID op sc	
Type: Uint	

26.10 PID feedback max value **26.12 PID feedback min value**	**Range:** -32768.000 to 32768.000
Default value: -100.00 100.00	
Displayed as : PID fb mx PID fb mn	
Type: Int32	

26.19 PID output upper limit **26.20 PID output lower limit**	**Range:** -100.00% to 100.00%
Default value: 100.00% -100.00%	
Displayed as : PID op mx PID op mn	
Type: Uint	

26.14 PID set point filter **26.15 PID source filter** **26.22 PID output filter**	**Range:** 0 – 30.000s
Default value: 0.1s	
Displayed as : PID st flt PID sr flt PID op flt	
Type: Uint	

26.16 Proportional gain **26.17 Integral gain** **26.18 Derivative gain**	**Range:** 0 – 65.535
Default value: Proportional gain 0.100 Integral gain 0.01 Derivative gain 0	
Displayed as : Prop gain Int gain Der gain	
Type: Uint	

Group27: Torque Control

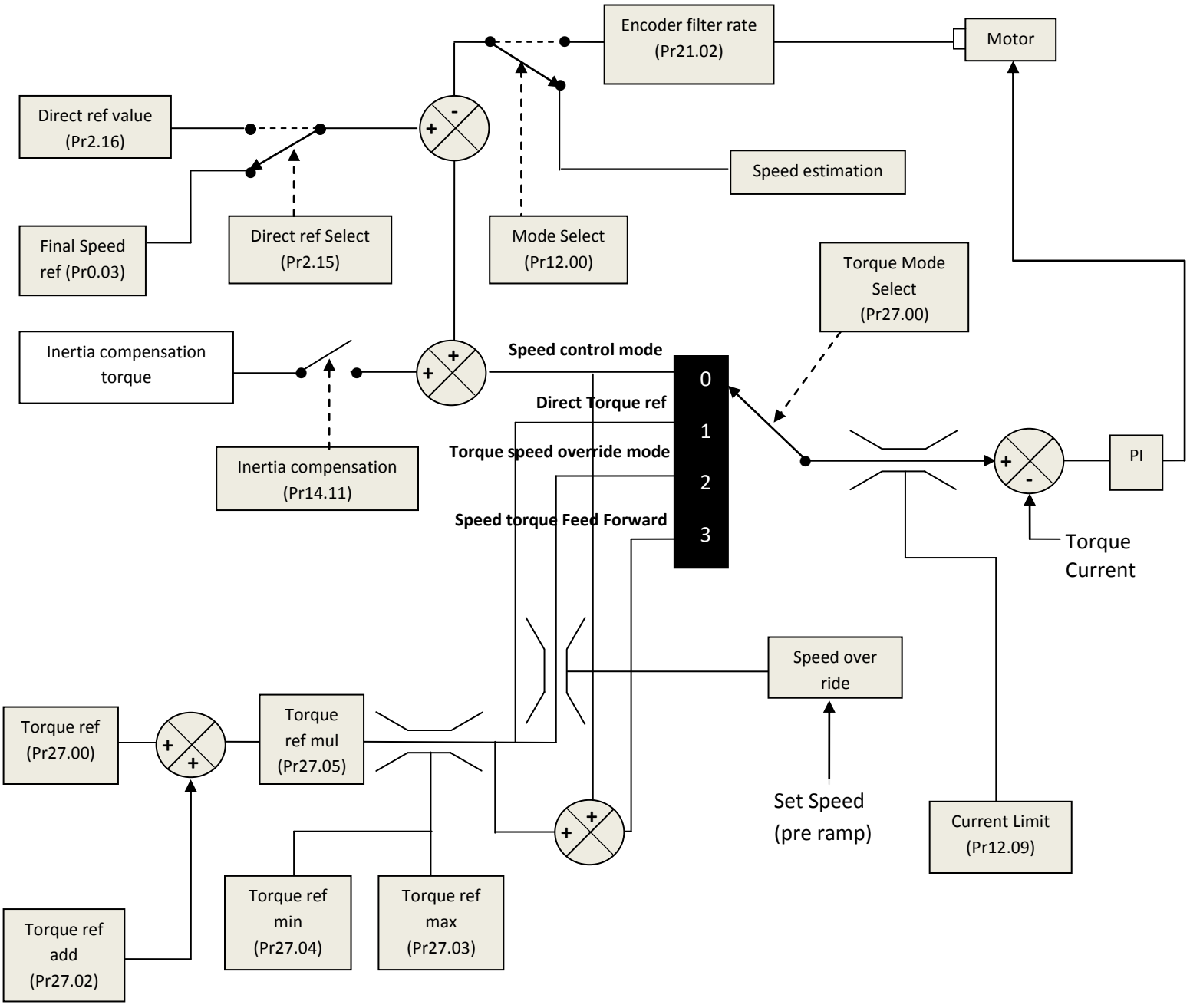
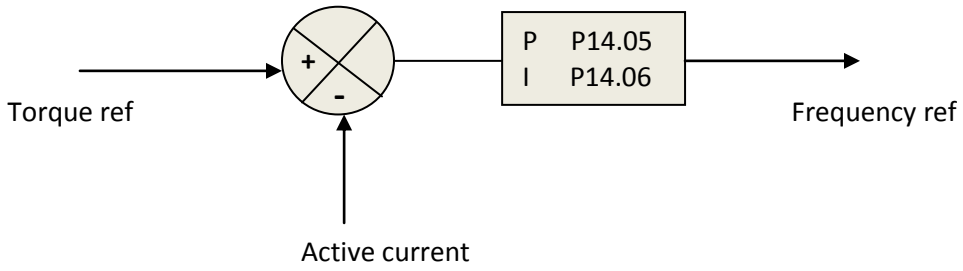


Fig-25 **Torque Control: FOC Mode**

27.00 Torque mode select	Range:
Default value: Speed control mode	0: Speed control mode 1: Direct Torque ref 2: Torque mode with speed override
Displayed as : Torq md selector	
Type: Txt	

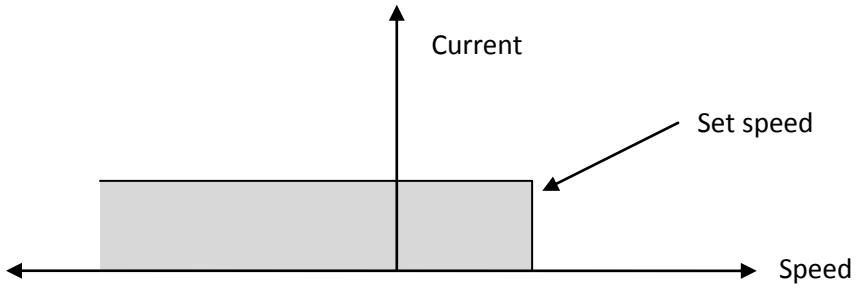
0. Disable: If torque mode is disabled drive runs in normal speed control mode.

1. Direct Torque ref:
V/f Mode



FOC mode
The speed is not limited in any way and under light load condition, over speeding can occur. However, drive trips if over speed threshold (**P2.19**) is exceeded.

2. Torque control with speed override:
The output of the speed loop is the torque demand. This is limited to a range of Torque ref max (**P27.03**)and Torque ref min(**P27.04**). If load torque is less than Torque ref, maximum speed of drive is limited by the set speed ref and there is no speed runaway. However, as load torque increases, drive speed drops and speed reversal is also possible.



27.01 Torque ref sel 27.02 Torque ref add	Range: Value Pointer
Default value: P00.49 P00.56	
Displayed as : Torq ref sel Torq ref add	
Type: Value Pointer	
Description: Torque_ref = Torque ref sel + Torque ref add	

27.03 Torque ref max **27.04 Torque ref min**	**Range:** -1.00 to 3.00
Default value: 1.00 0	
Displayed as : Torq ref max Torq ref min	
Type: Uint	

27.05 Torque ref multiplier	**Range:** -8.000 to 8.000
Default value: 1.000	
Displayed as : Torq ref mul	
Type: Uint	

27.06 Torque reference ramp up **27.07 Torque reference ramp down**	**Range:** 0.0 to 60.0s
Default value: 30.0s	
Displayed as : Torq Ref Ramp up Torq Ref Ramp dw	
Type: Uint	
Description: This is the time taken by torque ref to ramp up or down.	