BENSHAW®
ADVANCED CONTROLS & DRIVES

Pub. # 890049-02-00
June 2018

Quick Start Guide

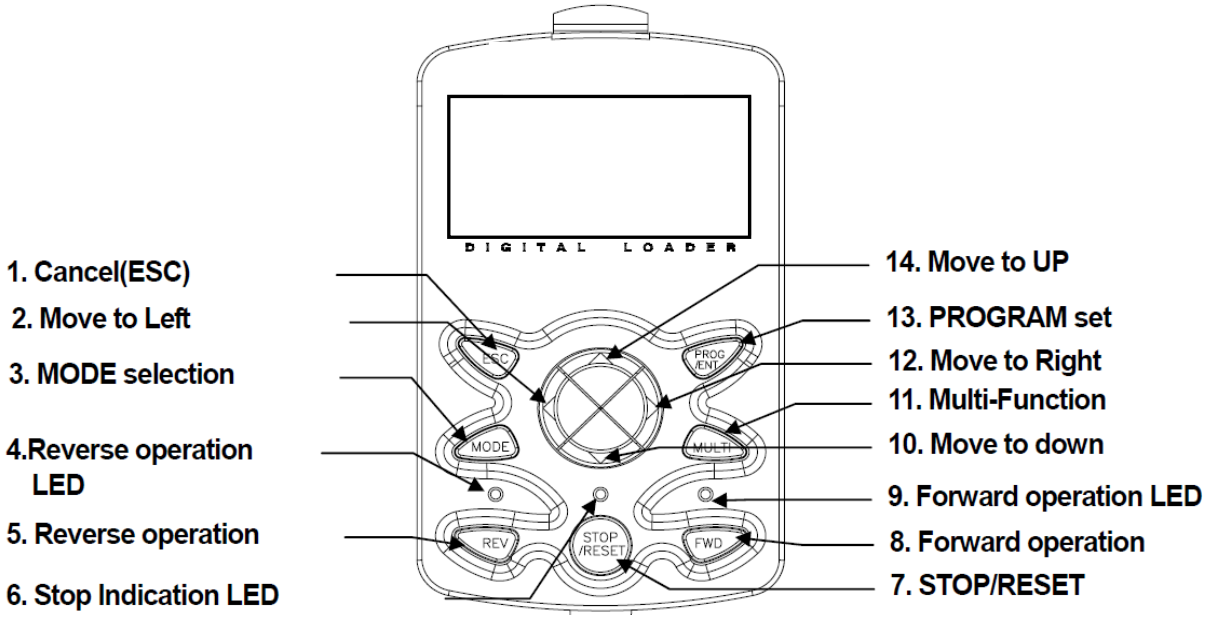
RSi "S" Series VFD

Using the Remote LCD Keypad/Display

Contents

This guide contains basic parameter settings for control and protection of a standard induction motor when using the optional remote LCD keypad/display. The default settings are used for a standard induction motor controlled with a linear (fixed) V/Hz. pattern with a base frequency of 60 Hz.

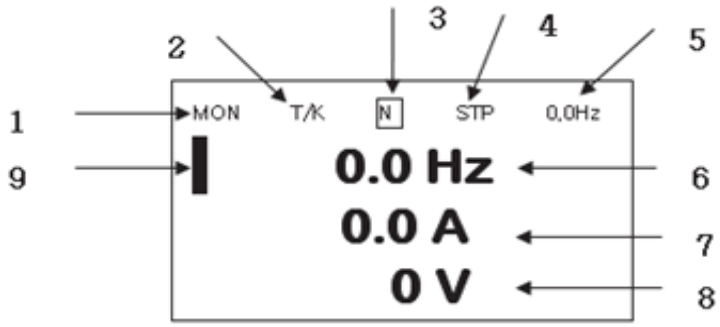
1. Keypad Buttons - Operation



Number	Buttons	Name	Description
3		Mode	Change Modes Monitor Mode -> Parameer Mode -> Configure Mode
13		Program/Enter	Press to change a parameter setting. Press again to save the change.
2, 10 12, 14		Up/Down Left/Right	Up/Down In Parameter Mode, move up/down within parameters. In Program Mode, increase/descrease/change parameter setting. Left/Right In Parameter Mode, move among parameter groups. In Program Mode, move curser
11		Multi Function	Assign to Jog, Local/Remote, User Grp Select or Keypad ID.
1		Escape (Cancel)	In Parameter Mode, move to first parameter in group. In Program Mode, escape without saving changes.
8		Forward	Forward Run command when in Keypad Control.
5		Reverse	Reverse Run command when in Keypad Control.
7		Stop/ Reset	Stop when running. Reset of Faults.

2. Display Fields - Explanation

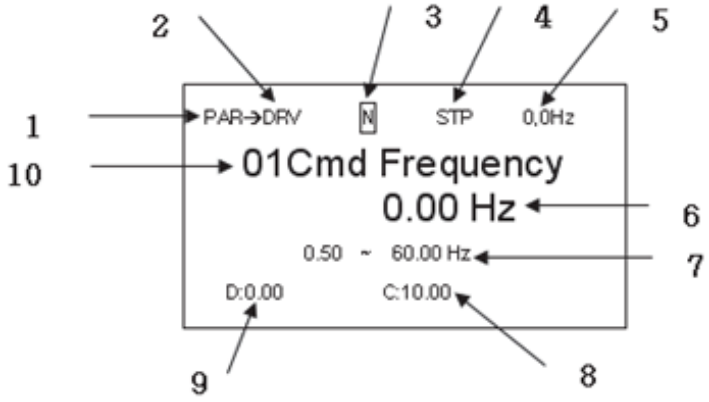
A. Display In Monitor Mode



#	Function	Display	Description
1	Mode Display		
		MON	Monitor Mode
		PAR	Parameter Mode
		TRP	Trip Mode
		CNF	Config Mode
2	Operating Command (Start/Stop)	K	Keypad
		O	Communication option
		A	Application operation
		R	Built-in 485 operation
		T	Terminal block operation
	Frequency Command (Speed Ref.)	K	Keypad frequency command
		V	V1 input frequency reference
		I	I1 input frequency reference
		P	Pulse input frequency reference
		U	Frequency reference during UP operation
			(Up-Down operation)
		D	Frequency reference during DOWN operation
			(Up-Down operation)
		S	Frequency reference during STOP operation
			(Up-Down operation)
		O	Communication Option frequency reference
		X	V2, I2 frequency reference from Extended I/O card
		J	Jog frequency reference
		R	Internal 485 frequency reference
		1~9 A~F	Sequential frequency reference

#	Function	Display	Description
3	Multi Function Key Setting	N	None
		J	When Prgrammed as JOG Button
		R	When Programmed as Local/Remote Button
		U	Selection Button for User Group
4	Inverter Status	STP	Stopped
		FWD	Operating forward
		REV	Operating reverse
		DC	DC Output
		WAN	Warning
		STL	Stalling
		SPS	Speed Searching
		OSS	Software Over Current Protection
		OSH	Hardware Over Current Protection
		TUN	Auto Tuning
5	Any Time Parameter	Hz	User Selectable
6	Monitor	Hz	Monitor Line-1
7	Monitor	A	Monitor Line-2
8	Monitor	V	Monitor Line-3

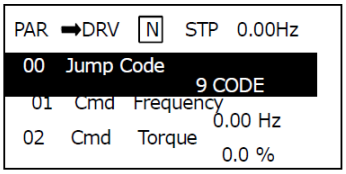
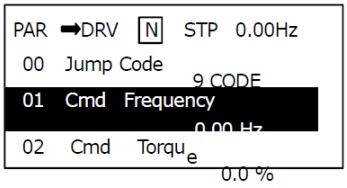
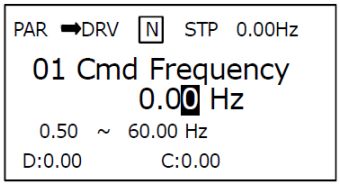
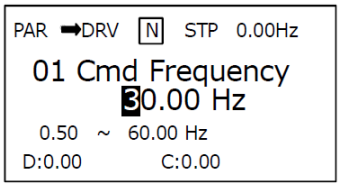
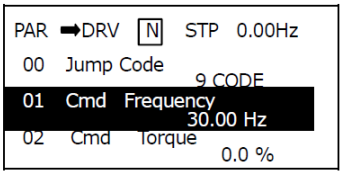
B. Display In Parameter Mode



#	Function	Display	Description
1	Mode Display	MON	Monitor Mode
		PAR	Parameter Mode
		TRP	Trip Mode
		CNF	Config Mode
2	Parameter Group	DRV	DRIVE Group
		BAS	BASIC Group
		ADV	ADVANCED Group
		CON	CONTROL Group
		IN	INPUT Group
		OUT	OUTPUT Group
		COM	COMMUNICATION Group
		APP	APPLICATION Group
		PRT	PROTECTION Group
		M2	M2 (2nd MOTOR) Group
		USS	US Group
		USF	UF Group
		TRP	TRIP (FAULT) Group
		CNF	CONFIGURE Group
3	Multi Function Key Setting	N	None
		J	When Prgrammed as JOG Button
		R	When Programmed as Local/Remote Button
		U	Selection Button for User Group

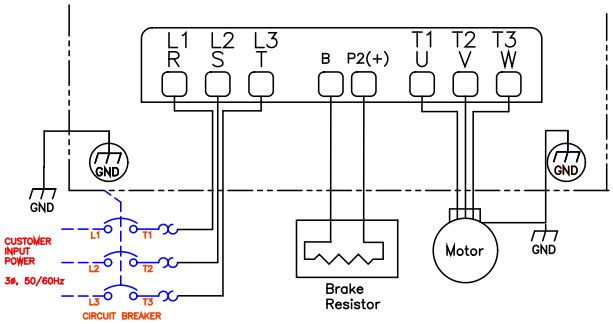
#	Function	Display	Description
4	Inverter Status	STP	Stopped
		FWD	Operating forward
		REV	Operating reverse
		DC	DC Output
		WAN	Warning
		STL	Stalling
		SPS	Speed Searching
		OSS	Software Over Current Protection
		OSH	Hardware Over Current Protection
		TUN	Auto Tuning
5	Any Time Parameter	Hz	User Selectable
6	Parameter Setting and Units		
7	Parameter Range		
8	Existing Parameter Value		
9	Parameter Default Setting		
10	Parameter Number and Description		

3. Parameter Setting - Example “Frequency Command”

	- Press the “MODE” button to get in the PAR (Parameter Mode). - The first parameter group is the DRV group.
	- Press the “Down” button to parameter DRV.01 (Cmd Frequency). - Press the “PROG/ENT” button.
	- The cursor flashes over the first digit to the right. - Press the “LEFT” button to move the cursor to the tens position.
	- Press the “UP” button (3 times), to increase the desired frequency to 30 Hz.. - Press the “PROG/ENT” button to enter (save) the new frequency.
	- The desired frequency has been changed to 30 Hz. - Press the “ESC” (escape) button to return to the main screen.

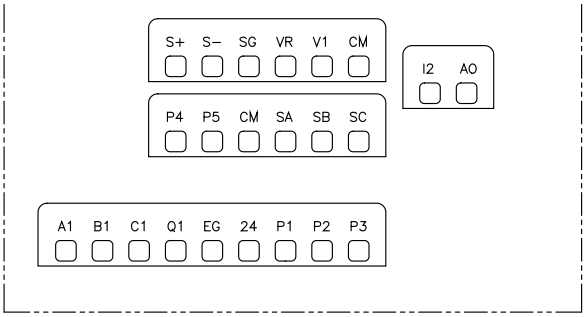
4. Wiring

A. Power Terminals



Recommended Wire Sizes Power, Ground and Control Wiring					
Voltage	HP	Power AWG		Ground	Control
		R/S/T	U/V/W	AWG	AWG
240V	1	14	14	12	18
	2				
	3				
	5	12	12		
	7.5	10	10	10	
	10				
	15	8	8	6	
480V	1	14	14	12	
	2				
	3				
	5				
	7.5				
	10	12	12	8	
	15				
Cable Spec		Copper, 600V, 75C			300V, 75C
Torque (max) in-lbs		5.3			2.2

B. Control Terminals



Control Terminals			
Terminal	Function	Parameter	Setting
P1	Start Forward	IN.65	1:Fx
P2	Start Reverse	IN.66	2:Rx
P3	Output Disable	IN.67	5:BX
P4	Reset	IN.68	3:RST
P5	Low Speed	IN.69	7:Sp−L
CM	Common	–	–
VR	10VDC Supply	–	–
V1	0−10VDC Speed Ref.	DRV.07	2:V1
CM	Common	–	–
I2	4−20mA Speed Ref.	DRV.07	5:I2
A1	Relay NO	OUT.31	29:Trip
B1	Relay NC		
C1	Common		
P24	24VDC Supply	For Q1	–
Q1	Open Collector Output	OUT.33	14:Run
EG	Ground	For Q1	–
S+	Communications RS−485 (Modbus)	COM.01 – COM.05	0: Modbus RTU
S−			
SG			
AO	Analog Output	OUT.01	0:Freq
CM			
SA	STO Safe Torque Off	–	–
SB		–	–
SC		–	–

Factory Jumper

5. Quick Start Parameters

A. Control (Start/Stop)

B. Speed Reference

C. Motor Parameters

D. Protection Parameters

					Settings	
	Function	Group	Parameter	Option #	Desc.	Default
A	Control (Start/Stop)	DRV	06	0	Keypad	1:Fx/Rx-1
				1	Fx/Rx-1	
				2	Fx/Rx-2	
B	Speed Reference	DRV	07	0	Keypad-1	0: Keypad-1
				1	Keypad-2	
				2	V1	
				4	V2	
				5	I2	
C	*Motor Parameters*					
	Load Type / Duty (Normal/Heavy)	PRT	04	0	Normal Duty	1: Heavy Duty
				1	Heavy Duty	
	Motor Capacity	DRV	14	0	0.3 HP	Varies with Drive Rating
				1	0.5 HP	
				2	1.0 HP	
				3	1.5 HP	
				4	2.0 HP	
				5	3.0 HP	
				6	4.0 HP	
				7	5.0 HP	
				8	5.5 HP	
				9	7.5 HP	
				10	10 HP	
				11	15 HP	
	Motor Poles	BAS	11	2 ~ 48		Dependent on motor setting
	Slip		12	0-3000(Rpm)		
	Motor FLA (rated current)		13	1.0-1000.0(A)		
	Motor No Load Current		14	0.0-1000.0(A)		
	Motor Rated Voltage		15	170-480(V)		230/460
	Motor Efficiency		16	64-100(%)		Dependent on motor setting
	AC Input Voltage (Source)		19	170-480(V)		240/480
	Motor Direction	ADV	09	0	None	0: None
				1	Forward Prev	
				2	Reverse Prev	
D	*Protection Parameters*					
	Input/Output Phase Loss Protection	PRT	05	0	Off	00 Displayed as:  Off/Off — 11 as:  On/On
				1	On	
	Overload		20	0	None	1: Free-Run
				1	Free-Run	
				2	Dec	
	Trip Level		21	30-200(%)		180
	Trip Time		22	0.0-60.0(s)		60
	ETH (Electronic Thermal Overload		40	0	None	0:None
				1	Free-Run	
				2	Dec	
	Motor Cooling Type		41	0	Self-cool	0:Self-cool
				1	Forced-cool	
	ETH (1 minute)		42	125-200(%)		150
	ETH (Continuous)		43	50-125(%)		120

6. Control and Speed Reference Settings - Detail

Start/Stop				
Keypad				
Terminal	Function	Parameter	Setting	
–	Command Source	DRV.06	0	Keypad
Press FWD button (green) to run forward. Press REV button (Red) to run reverse. Press STOP/RESET button to stop. For run prevention (forward or reverse), see parameter ADV.09.				

2–Wire Start/Stop Control				
Terminal	Function	Parameter	Setting	
	Command Source	DRV.06	1	Fx/Rx–1
P1	Start Forward	IN.65	1	Fx
P2	Start Reverse	IN.66	2	Rx
CM	Common	–	–	–

3–Wire Start Stop Control				
Terminal	Function	Parameter	Setting	
	Command Source	DRV.06	1	Fx/Rx–1
P1	Start Forward	IN.65	1	Fx
P2	Start Reverse	IN.66	2	Rx
P3	3–Wire	IN.67	14	3–Wire
CM	Common	–	–	–

Hand - Off - Auto				
Local - Off - Remote				
Terminal	Function	Parameter	Setting	
P3	Hand/Auto	IN.67	15	2nd Source
CM	Common			
Hand Mode				
-	Command Source	DRV.06	0	Keypad
			1	Fx/Rx-1
			2	Fx/Rx-2
-	Speed Reference	DRV.07	0	Keypad-1
			1	Keypad-2
			2	V1
			4	V2
			5	I2
Auto Mode				
-	Cmd Aux (2nd) source	BAS.01	0	Keypad
			1	Fx/Rx-1
			2	Fx/Rx-2
-	Frq Aux (2nd) source	BAS.02	0	Keypad-1
			1	Keypad-2
			2	V1
			4	V2
			5	I2
With P3 Input Open - VFD uses DRV.06 and DRV.07 setings				
With P3 Input Closed - VFD uses BAS.01 and BAS.02 settings				

Speed Reference				
Keypad				
Terminal	Function	Parameter	Setting	
–	Freq. Ref. Source	DRV.07	0	Keypad–1
In Monitor Mode (MON), program the speed reference from the main screen. In Parameter Mode (PAR), program the speed reference from DRV.01.				

Speed Reference				
4 – 20 mA Input				
Terminal	Function	Parameter	Setting	
I2	4–20mA Speed Ref.	DRV.07	5	I2
CM	Common	–	–	–
	View Input Signal	IN.50	View Only	
	Filter Time	IN.52	10	msec
Scaling of 4–20mA signal	Min. Input	IN.53	4.0	mA
	Output (%) at Min. Input	IN.54	0.0	%
	Max. Input	IN.55	20.00	mA
	Output (%) at Max. Input	IN.56	100	%
	I2 Inverting	IN.57	0	No

Speed Reference				
0 – 10 VDC (Potentiometer)				
Terminal	Function	Parameter	Setting	
VR	VDC Supply	–	–	–
V1	0–10VDC Input	DRV.07	2	V1
CM	Common	–	–	–
	View Input Signal	IN.05	View Only	
	Filter Time	IN.07	10	msec
Scaling of 0–10V signal	Min. Input	IN.08	0	V
	Output (%) at Min. Input	IN.09	0	%
	Max. Input	IN.10	10	V
	Output (%) at Max. Input	IN.11	100	%
	V1 Inverting	IN.16	0	No

7. Faults and Warnings

There are 3 levels of **Fault** conditions in addition to **Warning** messages.

- **Non-Latched Faults:** Do not require a Reset. When the fault is corrected, the fault or warning message disappears. The fault is not saved in the fault history.
- **Latched Faults:** Require a reset (keypad or external). When the fault is corrected and reset, the fault disappears. The fault is saved in the fault history.
- **Fatal:** Drive requires power to be cycled Off then On.

If the drive faults during operation, the drive immediately goes to the Trip Mode (TRP Mode) and the fault is displayed (Flashing) on the LCD display. Additional data about the fault is also displayed as parameters TRP-01 through TRP-09 (see below table). Press the down arrow button to view the additional data.

When a reset is performed (keypad or externally), the fault is stored and can be viewed in the TRP mode. The fault history (TRP Mode) stores up to the last 5 faults. Faults Last-1 through Last-5 can be viewed by pressing the right and left arrow buttons.

A. TRP Mode - View Fault History

TRP-Code	Name	LCD Display	Range	
00	Trip (Fault) display	Trip Name(x)	-	
01	Frequency reference at trip	Output Freq	Hz.	
02	Output current at trip	Output Current	A	
03	Inverter Status at trip	Inverter State	Stop/Accel/Decel	
04	DC Link Voltage	DCLink Voltage	VDC	
05	NTC temperature	Temperature	°C	
06	Digital Input terminal status	DI Status	On / Off P5 P4 P3 P2 P1 1 1 1 1 1 0 0 0 0 0	
07	Output terminal status	DO Status	On / Off Q1 R1 1 1 0 0	
08	Trip time after Power on	Trip On Time	Years/Months/Days Hours:Minutes	
09	Accumulated Run Time	Run Time	Years/Months/Days Hours:Minutes	
10	Delete trip history	Trip Delete?	0	No
			1	Yes

B. Voltage and Current Faults

Display	Fault	Type	Description	Related Parameters
OLt	Over Load	Latch	**Motor Overload.** Motor current exceeds the set overload levels. Activated when PRT.20 is set to 1 or 2 and the output current has exceeded the PRT.21 level (%) for longer than the PRT.22 time (seces.).	PRT.04, BAS.13, PRT.20, PRT.21, PRT.22
ULt	Under Load	Latch	**Motor Underload**. Motor current is less than the set underload levels. Activated when PRT.27 is set to 1 or 2 and the output current is lower than the PRT.30 level (%) for longer than the PRT.28 time (secs.). Active when the motor speed above twice the motor slip speed (freq.) BAS.12.	BAS.13, PRT.27, PRT.28, PRT.29, PRT.30
OCt	Over Current1	Latch	**Inverter Over Current-1.** Output current exceeded 200% of the rated current.	-
OC2	Over Current2	Latch	**Inverter Over Current-2.** Excessive output current indicating a short circuit condition.	-
Out	Over Voltage	Latch	**Over Voltage**. Internal DC bus voltage exceeded the trip level.	-
Lut	Low Voltage	Non-Latched	**Low Voltage.** Internal DC bus voltage is less than the trip level.	BAS.19, PRT.81
Lu2	Low Voltage2	Latch	**Low Voltage-2**. Internal DC bus voltage is less than the trip level.	BAS.19, PRT.82
GFt	Ground Trip*	Latch	**Ground Fault.** Ground current exceeds a fixed value, varies with inverter capacity (~30% for 30 msecs.).	
EtH	E-Thermal	Latch	Electronic Thermal Overload. Inverter has predicted a rise in motor temperature. Activated when PRT.40 is set to 1 or 2 and the output current has exceeded the PRT.42 or PRT.43 levels (%). Common Fault during low speed (<20 Hz.) operation.	BAS.13, PRT.40, PRT.41, PRT.42, PRT.43
POt	Output Phase Open	Latch	Output Phase Open. Current in one or more phases is less than 15% of inverter rated current. Activated when PRT.05 is set to 01.	PRT.05
IPO	Input Phase Open	Latch	**Input Phase Open**. DC Bus ripple voltage is higher than normal indicating a missing input phase.. Activated when PRT.05 is set to 10.	PRT.05, PRT.06
IOL	Inverter OLT	Latch	**Inverter Overload.** Output current has exceeded the Inverter rated current. Overload ratings for the inverter are 150% for 1 min and 200% for 4 sec.	-
nMt	No Motor Trip	Latch	**Low Current Fault** .Activated when PRT.31 is set to 1 and the output current is below the PRT.32 level (%) for the PRT.33.time (secs.).	BAS.13, PRT.31, PRT.32, PRT.33

* Ground Fault monitoring is not supported inverters 5.0 HP and lower. An over voltage Fault (ovt) or over current Fault (OCT) will occur.

C. Drive Faults

Display	Fault	Type	Description	Related Parameters
OHt	Over Heat	Latch	**Inverter Over Heat.** Inverter heat sink temperature exceeded 110°C.	-
HWt	H/W-Diag Trip	Fatal	Hardware diagnostic Fault. Error detected in the Inverter Control Board. Areas monitored are memory (EEPRom), analog-digital converter output (ADC Off Set), or CPU watchdog (Watch Dog-1, Watch Dog-2).	-
			EEP Err: An error occurred in reading/writing parameters due to keypad or memory (EEPRom) Fault.	
			ADC Off Set: An error in the current sensing circuit (U/V/W terminal, current sensor, etc.).	
FAn	Fan Trip	Latch	**Cooling Fan Fault.** Inverter detected an issue with the cooloig fan. Actiavted when PRT.79 is set to 0 (zero).	PRT.79

D. External Input Faults

Display	Fault	Type	Description	Related Parameters
Ext	External Trip	Latch	External Fault. Input signal at terminal Px set to (4) External Trip is activated.	IN.65 - IN.69
bx	Inverter Output disabled (blocked)	Non-Latched	**BX Fault, Inverter Disabled.** Input signal at terminal Px set to (5) BX is activated.	IN.65 - IN.69
ntC	NTC Open	Latch	Internal Temperature Sensor Fault. Temperature sensor of the Insulated Gate Bipolar Transistor (IGBT) is open or sensing below 10°C.	-
Pid	Pre-PID Fail	Latch	In Pre-PID mode, PID feedback is measured below the APP.35 level (%) for longer than the APP.36 Pre-PID time (secs.).	APP.34, APP.35, APP.36
xbr	Ext-Brake	Latch	When using External Brake Control, the Inverter output starting current remained below the value set at ADV.41, Brake Open Current.	ADV.41, ADV.42
SFA/SFb	Safety A(B) Err	Latch	Safe Torque Off Fault. One of the two safety (STO) input terminlas (SA, SB, SC) is open.	-

E. Communication Faults

Display	Fault	Type	Description	Related Parameters
LOr	Lost Command or Reference	Non-Latched	**Lost Command Source** (Start/Stop control): Lost command over communcations (RS-485 and other network options). **Lost Frequency Reference Source** (Speed control): Lost speed reference via analog or communications.	PRT.12, PRT.13, PRT.14, PRT.15
IOt	IO Board Trip	Latch	Conbtrol board (I/O board) or external communication card is not connected to the inverter.	-
ErrC			Displayed when the error code continues for more than 5 sec. Displayed as: ('Errc' -> '-rrc' -> E-rc' -> 'Er-c' -> 'Err-' -> '- -rc' -> 'Er- -' -> '- - - -' -> 'Errc' -> …)	
PAr	ParaWrite Trip	Latch	Parameter Writing Error when using remote display (LCD). Displayed when communication fails during parameter writing due to a control cable Fault or a bad connection.	-
OPt	Option Trip-1	Latch	**Option Board Fault.** Error is detected between the inverter and the communication board.	-

F. Warnings

Warnings: All warning messages have to enabled with the associated parameters, except IOLW (Inverter Overload Warning). The most recent warning message can be viewed at PRT.90.

Display	Warning	Type	Description	Related Parameters
OLW	Over Load	Warning	**Motor Overload Warning.** Activated when PRT.17 (overload warning) is set to 1 and the motor current is above the PRT.18 level (%) for longer than the PRT.19 time (secs.). One of the digital output terminals (Relay 1 or Q1) can be set to 5 (Over Load) to output the warning.	PRT.04, PRT.17, PRT.18, PRT.19, OUT.31, OUT.33
ULW	Under Load	Warning	**Motor Underload Warning**. Activated when PRT.25 is set to 1 and the output current is lower than the PRT.30 level (%) for longer than the PRT.26 time (secs.). One of the digital output terminals (Relay 1 or Q1) can be set to 7 (Under Load) to output the warning.	BAS.13, PRT.04, PRT.25, PRT.26, OUT.31, OUT.33
IOLW	INV Over Load	Warning	**Inverter Overload Warning.** Displayed after 36 secs. of a 150% overload. One of the digital output terminals (Relay 1 or Q1) can be set to 6 (IOL) to output the warning.	OUT.31, OUT.33
LCW	Lost Command or Reference	Warning	**Lost Command Warning**: Lost RS-485 communications at the terminal block (Start/Stop or Speed Reference) or lost analog speed reference based on the conditions set at PRT.13- 15. Warning occurs even with PRT.12 set to 0. Applies to both Start/Stop control (when over communications) and Speed Reference via analog or communications. One of the digital output terminals (Relay 1 or Q1) can be set to 13 (Lost Command) to output the warning.	PRT.12, PRT.13, PRT.14, PRT.15
FAnW	Fan Warning	Warning	Cooling Fan Warning. Activated when PRT.79 is set to 1. One of the digital output terminals (Relay 1 or Q1) can be set to 8 (Fan Warning) to output the warning.	PRT.79, OUT.31, OUT.33
dbW	DB Warn %ED	Warning	**Dynamic Brake Warning.** DB resistor usage rate exceeds the set percentage.	PRT.66
trtr	Retry Tr Tune	Warning	**Sensorless Auto Tuning warning.** The warning occurs when the motor's rotor time constant (Tr) is either too low or too high.	DRV.09, BAS.20